THE GEOGRAPHICAL JOURNAL

H 1

VOLUME LXXXII

JULY TO DECEMBER

1933

PUBLISHED UNDER THE AUTHORITY OF THE COUNCIL

EDITED BY THE SECRETARY

THE ROYAL GEOGRAPHICAL SOCIETY

KENSINGTON GORE LONDON S.W.7

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The
GEOGRAPHICAL JOURNAL

Vol LXXXII No 1 R.G.S. *July 1933*

THE GEOGRAPHICAL WORK OF H.R.H. THE LATE DUKE OF THE ABRUZZI: *A paper read at the Evening Meeting of the Society on 15 May 1933, by*

PROFESSOR GIOTTO DAINELLI, Accademico d'Italia

THE honour of commemorating H.R.H. the Duke of the Abruzzi, and especially of commemorating him in this place, is such as to cause deep emotion to one who has always, ideally, felt himself to be a faithful and devoted follower of the great Prince. But one thought is my encouragement, that in no place other than here amongst Englishmen who are accustomed to bold enterprises on all the seas and on all the mountains of this Earth, would it be possible to find a keener and a more complete understanding of this great and noble figure.

For us Italians however the figure of the Duke of the Abruzzi has a moral significance which reaches beyond his glorious activity as an explorer; for he has been, to us, an example and a pure symbol, a forerunner and a prophet, in grey times, of the actual rebirth of our country.

For this reason a thought full of gratitude goes, from Italians, to the proud and magnanimous resolution of King Amedeo, his father, who freed this great son of his from the destiny to which his birth would inevitably have bound him, and restored him to Italy, to be solely and completely an Italian Prince, free to obey that call which he felt towards all great actions and by which he has affirmed himself, not only as an Italian Prince with the age-long virtues of his family, but a truly national hero. To commemorate him in a worthy way will be an arduous task even later, when the pain has somewhat abated. Arduous, because H.R.H. the Duke of the Abruzzi was a sailor, a man of war, an alpinist, an explorer, a pioneer, and there is no one capable of speaking of the whole of his varied and complex activity, with any hope of describing it with the required efficiency. In this place we shall limit ourselves to remembering only the explorer.

Doubtless however two natural predilections—the sea and the mountains—which the Prince felt strongly even in his earliest youth, helped to form the explorer. He was bound to the sea before his love for it had shown itself; for the severe discipline of duty, which is a rule of life for all Italian Princes, made him a sailor in the Royal Navy at six years of age, when our sons are still left

to their mothers' care. When he was sixteen, he sailed along both coasts of South America. Then, on a small gunboat, he made long cruises in the Atlantic and the Indian Oceans. Immediately afterwards there followed the great voyage in the seas of India, China, and the South Seas, and North and South America. When he returned to his own country after so long an experience on all the seas, under every climate, by sail and by steam, in enervating calms or in raging storms, among every land and every people, the Prince, though hardly more than twenty years old, was already a really accomplished seaman.

And between one sea voyage and another, when any one would have felt the right and the wish to rest—for the sea does not signify rest for those who have the responsibility of obedience or of command—between one navigation and another, the Prince, still very young but already used to dangers and discomforts, to rapid decision and intelligent courage, felt the call of those Alps, which seemed like a perfect amphitheatre closing in around the plains of his Piedmont. After his first initiation, he immediately showed himself to be a first-class alpinist: he was only twenty-one when he could count the Charmoz, the Little Dru, and the Grépon, till then only climbed by a few foreign alpinists, the Dent Blanche and the Rothhorn, among his numerous climbs. He had conquered the Matterhorn, even by the Zmutt route, which required the perfection of alpine technique and a courage which seems to border on audacity.

And it was not a passing whim. When he left the sea he always went to the mountains. New ways and new climbs were added by the Prince to the history of Italian Alpinism. Let us record only the ascent from the Charpona glacier to that Aiguille Sans Nom to which he gave the name of his faithful guide Petigax, the rocky peak of the Grandes Jorasses which became then the Punta Margherita, and one of the slender, steep Dames Anglaises which is to-day Punta Iolanda.

It is said, and truly, that those who love and understand and know how to conquer the mountains often remain indifferent spectators to the beauties of the sea, and that those who feel the fascination of the sea often remain without the slightest understanding of the divine majesty of the mountains. But he who has the full and complete understanding, both of the mountains and of the sea, must possess a remarkably keen and wide soul.

The sleepless and tiring nights on deck and the nerve-racking hours on the bridge of command, when the life of all and the safety of the ship may depend on one man's actions, are sufficient to harden a man. And he is also strengthened by the fight with the sudden burst of the storms, the solitary bivouacs, the anxiety of imminent danger, which must be measured and overcome by the alpinist, to ensure his own and his companions' safety and victory. But he who has had long experience in active navigation and also in alpinism is certainly prepared for any daring undertaking.

For us Italians however the sea and the mountains also form the boundaries of our country. And to be alpinist and sailor, at the same time, must mean a great devotion to our land and the wish to dedicate every thought and every action to its greatness. Few citizens have worked for the glory of Italy as much as H.R.H. the Duke of the Abruzzi, solitary, silent, almost taciturn, but ever sustained by the traditions of his great House, morally and physically prepared

H.R.H. the late Duke of the Abruzzi

Phot. V. Sella

Alaska 1897: Mount St. Elias from the Seward glacier

by his love and experience of all seas and mountains. The sea in fact had shown him that, for those who choose, the ways of the world are open; the mountains had taught him, with the conquest of our earthly summits, the way towards the ideal ones.

A little less than two centuries ago there appeared to the Russian navigator Bering, when sailing near the coast of Alaska, a high mountain, from the mighty pyramid of which glaciers and snowfields descended till they joined in an immense expanse of ice, between the foot of the mountain and the sea. The mountain was named Saint Elias after the Saint on whose day the discovery was made. Half a century later an Italian seafarer, Don Alessandro Malaspina, during his search for the North-west passage, again saw that mountain enthroned among the clouds; his name was given to the large glacier at its foot.

This was the period of discovery: much later began its difficult conquest, because of the distance from any base of operation, the breakers along the coast, a belt of woods and marshes, the immense expanse of ice, and also because of the frequent fogs and snowfalls. Because of all this, the progress was slow and the undertaking seemed as if doomed to fail. The repeated efforts of Russel, who succeeded at his second attempt in 1891 in reaching a col, 4400 metres in height, seemed superhuman. Russel's name is borne by this col at the northern foot of the final pyramid. Into this still unconquered field descended the young Italian Prince, although scarcely twenty years of age, in 1897.

Italy was a very distant base for organizing an expedition into Alaska; but already the perfect spirit of organization of the Prince showed itself, as though he had already had long experience in exploration. His companions were few: Francesco Gonella, who had initiated the Prince into the difficulties and the joys of Alpinism; Commander Umberto Cagni; Vittorio Sella, more an artist than a photographer of the great mountain world; Filippo De Filippi, who became later the historian of this and of other expeditions; a few alpine guides, and a small group of American porters to be employed only during the approach to the mountain.

Difficulties began on landing, which was delayed by the swell and the breakers; they were still greater on the large glacier, an immense extension which nearly forbade all access to the mountain. There were thirty days of laborious advance, with fog and frequent snowstorms, with much difficulty in pulling the loads, on the little sleighs, among a labyrinth of crevasses up the steep slopes from one plateau to another. Then began the real climb, more worthy of alpinists, and the Russel Pass was reached. So far they were on the tracks, so to say, of their predecessor. But from there onwards it resembled the charge of a patrol of *arditi;* the Prince at the head of all, the most untiring of all. Eleven hours of continual climbing from the pass upwards, with only the brief halts that were required to make necessary observations or to calm the breathing; but without uncertainties straight to the top. And on the top, at more than 18,000 feet high, ten Italians answered with one voice to the "Viva il Re" which the victorious Prince flung to the sky.

The return seemed like a race, first to the pass, then to the large treacherous expanse of the Malaspina glacier, then to the sea. In the first small village

there came to meet the Duke an alpine explorer who had also attempted to climb that same mountain: he had landed there ten days before the Duke, and had also preceded him in the return, giving up however the final climb to the top.

For years seamen and students had been fascinated by the great unknown blank that surrounded the North Pole. But the general imagination—which tried to picture this gigantic polar dome as covered with ice, never visited by man, desolate, mysterious, almost hostile—gave an almost tangible shape to that point of it which constitutes its centre, and is at the same time nearly the apex of the Earth. Then there grew the anxiety, not only of revealing the polar mystery, but also of reaching the Pole, like a far-off and coveted ideal goal. Coveted, but far away and surrounded by its own ice barriers: not flat and uniform and motionless, as they were imagined at first, but drifting continually and subjected to pressure and expansion which continually form large abysses or raise tall shapeless banks.

It was also soon discovered that it was impossible for ships to break through that strong barrier of polar ice. Only man might adventure on its large expanse. The fight thus grew harder and more dramatic, also more fascinating: man, alone, amidst the immense and hostile polar solitude. It was a fight that became nobler the more immaterial the goal appeared: a truly ideal goal, made for the sanest and strongest virtues of man. The principal stages in Polar Exploration were the following: in 1773 Phipps, an Englishman, reached with his two ships a northern latitude of 80° 48′; in 1827 Parry, an Englishman, with his launches, that were transformable into sledges, attained 82° 45′; in 1875 Markham, also an Englishman, ventured as far as 83° 20′; in 1882 Lockwood, an American, went only 4 miles farther than his predecessor; in 1895 Nansen, the Norwegian, taking advantage at first of the drift of the ice itself, reached 86° 13′. It seemed as though this was a field open only to the daring of the more northern races.

But wherever there was an enterprise more daring than any other; wherever there was a goal to be attained that was above any other; wherever there was a battle to fight and glory to conquer, there the young Prince of Savoy stepped forward, to take part in the competition of heroism. So it was also in 1899. His two great loves for the sea and for the mountains showed him where to choose his men: Cagni, Querini, Cavalli Molinelli, were men of the sea; also two seamen who were chosen to go with the sledge parties; and four alpine guides from the valley of Aosta.

The remembrance is still alive in us of the perilous navigation of the *Stella Polare* amidst the island labyrinth of Franz Josef Land; the unsafe anchorage in Teplitz Bay; the daily and hourly conflict with the ice; the sudden abandonment of the ship, which seemed as if it was going to be hopelessly crushed by the powerful pressure of the ice; the feverish work to construct a shelter on firm ground and to save the ship. Then followed the dark, cold polar night. But during the polar night the last preparations were made for the final attempt; during this time also the patient training of the dogs continued, with the sledges, which were loaded as they would have to be for the final race to the Pole.

Phot. H.R.H. Duke of the Abruzzi

Arctic Expedition 1899–1900: "Stella Polare" crushed by the ice in Teplitz Bay

Phot. V. Sella

Ruwenzori 1906: Punta Alessandra (left) and Punta Margherita (right) from the Stanley glacier

During one of these experiments an unexpected slope, that ended in a sudden descent onto the frozen sea, made the dogs and the sledges go too fast to save themselves, and the Duke, from a bad fall. And when, after endless toil, they at last returned to their companions, the Duke's hands were frozen beyond recovery. What greatness in the simplicity of the words with which the Prince told us of this misadventure, which necessitated the amputation of part of his fingers and forced him to entrust Cagni with the command of the sledge parties bound towards the Pole.

Then began the long waiting, more tiring even than action itself. There was still some work to be accomplished at Teplitz Bay on the ship which was still in danger. But the wait for the sledging parties took up all the leader's anxious thoughts. One group, the first one, did not return: all honour be to the vanquished in the Polar strife! But the second came back. Then finally, when the waiting had begun to be almost unbearable, the third party arrived from quite an unexpected direction, imposed by the inexorable drift of the ice: Cagni and the sailor Canepa, Petigax and Fenoillet, the alpine guides, at the very end of their resources, but still steadfast of soul, as on the day of their departure towards their uncertain destiny: they had been victorious, for they had carried the flag which had been entrusted to them by H.R.H. the Duke of the Abruzzi to a latitude of 86° 34′, a latitude that had never been reached before.

An ancient tradition said that the Nile rises in high snow-topped mountains. Only about fifty years ago however the Italian Gessi, whilst exploring the shores of Lake Alberta, had what appeared like a strange vision of snowy peaks which seemed to float and vanish in the sky. He took it for an optical illusion. And it was only in 1888 that Stanley really saw a shining white massive-topped mountain, Ruwenzori. But Ruwenzori, because of its position, its natural surroundings, and also its height, is nearly always surrounded by clouds; for that reason many travellers had passed along the edge of its slopes, without seeing it, without even suspecting its existence. For the same reason all attempts to climb it had failed, even those who had succeeded in reaching a ridge or a peak of its vast massif had in the end been able to tell us little to add to our knowledge of the mountain. Ever since the first year after its discovery attempts to climb it had followed rapidly; men like Freshfield and Mumm had tried their skill on it. But the mountain held itself impenetrable amidst a barrier of its clouds. And this explains why Stanley, its discoverer, a few years before his death, begged that some person devoted to his work, some lover of the Alps, should choose Ruwenzori as a goal, and should make a complete study of it, exploring it in all its wide valleys and deep gorges.

H.R.H. the Duke of the Abruzzi took up this message, which sounded like a challenge, and during the first months of 1906 he was preparing, with his usual perfect spirit of organization, his new expedition. Amongst his old faithful followers the Prince chose again Cagni, Sella, Cavalli; added a naturalist, Roccati, and a strong party of Alpine guides from Courmayeur, and then left to attack the mountain. Perhaps during the inevitable delays of preparation, rapid though this was, he may have feared to arrive too late in this noble strife: in fact, whilst still busy with preparations, between the months of January and

Ruwenzori 1906: Punta Alessandra (left) and Punta Margherita (right) from the Stanley glacier

April of that year, seven attempts were again made to conquer the mountain, which failed however like the preceding.

To climb Ruwenzori was a really new undertaking, new even in the means and in the surroundings: instead of the great extensions of ice in the polar region, here were the warm and damp and thick equatorial forests; instead of sledges, the long line of native carriers; instead of complete solitude of the most desolate nature, an exuberance of life and a little crowd of primitive humanity. But when the expedition finally reached Bujongolo, it was then on the threshold of a high-mountain world, and the high-mountain world is everywhere the same, under every climate, and in any part of the Earth, and it is ever admirable in its magnificence, even if, as with Ruwenzori, it likes to hide amongst the clouds and looks as if it wanted to escape from the equatorial heat into the frequent rain of thunderstorms. There were fogs and threatening clouds, insistent thin rain, or sudden and violent downpours. But "The King of the Clouds" was conquered at last; conquered with all its peaks: nineteen above 4500 metres high were climbed, and of these sixteen by the Duke, including the highest of over 5100 metres. And the course of the ridges and of the valleys was determined, the structure of the large massif finally recognized. The wish of Stanley was now fulfilled, the challenge, that had been accepted, was won.

With his predilections and with his experience the Prince could not remain insensible to the appeal of that part of the world where the mountains assume such shapes and heights as to appear almost the consummation of all alpine beauty. I speak of the Karakoram, one of the numerous Himalayan ranges, wherein the Baltoro glacier offers a field worthy of the most daring effort.

You will remember, among the first pioneers in this field, Sir Francis Younghusband, who penetrated into it in 1887, when, at the end of his memorable journey from far-off China to India, he found his way suddenly blocked by the high range of the Karakoram. Godwin Austen had already been over the main tongue of the Baltoro glacier, as far as that large terminal basin where immense glaciers join from all directions and which is dominated by K_2, more than 8600 metres high. Then Lord Conway, who made the first climb in this range, had reached in 1892 the top of a peak of nearly 6900 metres high. The following expedition, led by Eckenstein in 1902, proved only how the mountain, K_2, in all its grandeur, showed itself adverse to being conquered.

H.R.H. the Duke of the Abruzzi, always ready for every great deed, set out in 1909 towards the Baltoro. His companions were Sella, Negrotto Cambiaso, De Filippi, and a reliable group of alpine guides from Courmayeur. But in the attempts to climb the giants of the Karakoram, the Prince this time went alone with his faithful mountaineers from the Val d'Aosta. And K_2, the gigantic and majestic pyramid, was studied, was attempted on every side, up to the last lateral saddles, which gave one a view over the northern slopes of the range, towards a sea of peaks and glaciers until then unknown. But K_2, the giant of all, remained unconquered.

Others might have been content with this fine exploring campaign; not so the Duke, and while he was leaving the untamed giant, he saw in front of him a high snowy mountain, the Bride Peak, lower than K_2, but still worthy of being attempted. And the patient climb began, from one fall of séracs to

Phot. V. Sella

Karakoram 1909: K2 from the Godwin Austen glacier

Somaliland 1928: the Duke's caravan crossing the Webi Shebeli

another, till the last short slope that would have led directly to the summit. But there, within 150 metres of the summit, with only a moderate effort needed to reach it, the mountain seemed to defend itself against the daring climber, who clung to its rugged shoulders cloaked with snow. It shrouded itself in a sea of dense fog; and this barrier would not be removed. It seemed, on the contrary, to enclose it the more surely; and in the end, when every hope failed, it became necessary to abandon the final achievement.

To reach the summit has a moral significance, which only the true alpinist can feel in all its power. On the Bride there was something greater than merely reaching the summit, even though a new summit. Here men were striving, in ideal competition, toward the greatest altitude yet reached by man. Dr. Longstaff had reached 7134 metres on Trisul, and he, an Englishman, then held the record, though some doubt remained concerning a slightly higher altitude Graham was said to have reached on Mount Kabru. These records however had now been conquered by the Prince, who with his bivouacs at 7500 metres attained the greatest altitude then ever reached by man by his own efforts on the mountains.

Twenty years elapse, many years of war and of turmoil. When this was at its worst the Prince again wished to be an example to all Italians. In 1920—it is necessary to remember that date—when many things seemed about to fall in ruins, he showed that, on the contrary, it was necessary to begin to work tenaciously to build up, with courage and faith, "Ardisci e spera," as was the motto which the August Queen had given him for one of his great enterprises. In 1920 H.R.H. the Duke of the Abruzzi, as if he wished to start a new life, went to Somaliland, into the interior, where the woods near the river Webi Shebeli are only a feeble defence against the heated plains, arid for the greater part of the year, and showing, only after the rains, some green but meagre pasture for the nomads' flocks. And there along the Webi Shebeli he became a pioneer, and gave life to one of the most important agricultural enterprises that our colonies have known. Where the herds of cattle used to linger and graze there is now a great fervour of initiatives: new works, machines, cultivated lands, villages, canals, factories, where throbs the life of the colonists and of the natives.

But because of the unchanging laws of the climate it is only from the river that the ground can get the fertilizing water, and the river shows itself, in its floods, to be strangely irregular, perhaps also insufficient, if one is thinking not only of to-day's works, but also of to-morrow's. The Webi however, except for the last part of its course, could still be called an unknown river. Many travellers had partly followed it, or crossed it, or only just reached it; but they were travellers of that epoch of exploration which had given us only the general lines, not the details, of the Earth's features. In 1928 the Duke of the Abruzzi, no longer young, organized his last expedition between Abyssinia and Somaliland, and reaching that region of Sidamo, where the sources of the Webi were still hidden, he followed that river in its entire course, from gorge to gorge, from one bend to another, until it opens out into the plains of sand and there loses part of its water. The work of his predecessors is completed, because that river to-day holds no more mysteries.

These are the achievements of the Prince explorer, and we need not record all that he brought back, from each of his undertakings, for the progress of Science. Even had he not done so, his high moral figure would not be diminished in the least, for it has a very different and deeper and more essential root. Because he has shown that human life is fine and noble and worthy of being lived, only if it escapes from a too comfortable and quiet life, and knows, on the contrary, how to accept, always and in all places, the fight for an ideal aim. His life indeed has always appeared like a striving without end, because always renewed, towards always more distant and always more elevated goals: towards those same goals which are well known to you, my English friends.

Therefore his is a figure that dominates and seems surrounded by a halo of heroism: and great he was until the very end.

A comparison comes to my mind with one of your heroes. When Captain Scott was dragging himself along in his tragic return from the Pole, Oates, one evening, feeling himself to be at the end of his strength, got up and went out of the little tent, saying simply to his two companions: "I am just going outside and may be some time." And he walked off in the ice, amidst the snowstorm, to die, all alone, where he had fought and won.

And the Prince explorer, when he knew that the end was inexorably near, left his town and his palace, and to those who had the sad fortune of greeting him for the last time, he simply said: "Don't ask for news of me any more," and he too went, to die on the field of his last struggle and of his last victory. And perhaps, when sailing from Genoa, he may have gone back, in his thought, to all his voyages on the sea, from the time when he learnt as a princely child that life must be, always and for every one, a school of duty; but a duty which it is given to few to accomplish heroically as the Prince has done.

Sailing from Genoa, he may indeed have gone back, to all his enterprises: Saint Elias, *Stella Polare*, Ruwenzori, Baltoro, Shebeli, and perhaps he may have heard as an echo the distant voice of the poet who had sung him on the glorious and sad day of his return from the Pole.

And as he left his beloved Italy for ever he may have felt the love made of endless devotion which floated about him, the love of those who saw in him an example and the purest of symbols; above all, those who were young when he was fighting and winning his noble battles, young himself, remembered how their love for their country and the infinite craving for its greatness were upheld by an unshaken faith, even during the mediocrity of the greyest times; but this faith was again and again animated and strengthened by the young Prince, who, with every new action of his, always knew how to stand up high again, for Italy, in the world.

For to him, to the Prince, in those hazy times in which he lived his vivid youth, there must have appeared as in a vision of light an active and productive Italy such as the poet had sung, inspired by his great deeds, almost foreseeing the great renewal of to-day. Inspired indeed was the poet by the great deeds of our hero Prince, for whom the path marked by destiny seems to have been unique and immutable: TO WILL, TO DARE, TO CONQUER ALWAYS!

DISCUSSION

Before the lecture the PRESIDENT (Admiral Sir WILLIAM GOODENOUGH) said: Our meeting to-night has particular significance. It is of great geographical interest and it has a special intention of commemorating one who, in various ways, occupied himself with and devoted himself to those activities which we profess in this Society. I need hardly say I speak of His Late Royal Highness the Duke of the Abruzzi. It was my privilege some weeks ago, a few days after his death, to speak of him from this platform. I will not repeat what I said then, but I will reserve such remarks as I have to make on his work until later in this meeting.

That work will be described to us by one who is eminently qualified for the task, Professor Giotto Dainelli, Accademico d'Italia. Professor Dainelli tells me that although he did not himself travel with the Duke, he was on terms of intimate friendship with him; they were in sympathy in their endeavours. The Professor is a mountaineer, a geographer, a man of science. He is also an Honorary Member of this Society and, if he will allow me to say so, an old and valued friend. May I mention that the slides which he will show this evening are taken from books which were written by the Duke of the Abruzzi. I will at once invite Professor Dainelli to address us.

Professor Dainelli then delivered the address printed above, and there followed tributes to the memory and work of H.R.H. the Duke of the Abruzzi.

Mr. J. M. WORDIE: I should like to speak mainly about the Duke of the Abruzzi's Arctic expedition in the *Stella Polare* in 1899–1900, but before doing so must say a few words about his earlier expedition to Mount St. Elias in Alaska. This great mountain, which lies not far from the 60th parallel, is technically outside the Arctic Circle, but in all other respects—climate and weather, remoteness, and methods by which it is reached—it must rank as of truly Arctic nature. It was the scene of the Duke's first expedition and first success in 1897, and it was on the experience then gained that he was able to plan and organize the attempt on the North Pole two years later. The ascent of Mount St. Elias, which was itself a notable feat, was only the prelude to a still greater adventure.

Before 1897 Mount St. Elias had already been attacked on more than one occasion, and it was known that the problem was twofold: first to reach the foot of the mountain across glacier country, much of it heavily crevassed, and then to climb the final 10,000 feet above the Malaspina Glacier. The mountain was only reached by the Duke's party with difficulty, and on the final glacier it required as much as thirteen days to cover the last 8 miles. This slow rate was due partly to difficult going and partly to bad weather; but these could only temporarily delay a well-organized party; the final assault was quickly made, and the summit reached on July 31, thirty-eight days after leaving the coast.

It seems doubtful what it was which first attracted the Duke to the mountain, but he was influenced perhaps by the knowledge that the great Malaspina Glacier takes its name from one of his own countrymen who, in 1792, commanded a Spanish ship seeking for a north-west passage in Alaskan waters. Whatever the impulse, the result was a triumph for good organization and well-chosen personnel. A special tribute must be paid to the Italian alpine guides who overcame every difficulty. The St. Elias expedition, in fact, marks the beginning of Arctic mountaineering almost as much as Lord Conway's expeditions to Spitsbergen in 1896 and 1897; much the same methods were employed, and such differences as there were were mostly such differences in detail as might be expected from the work of different nations.

Mount St. Elias stands like a great pyramid above Yakutat Bay. The lower

slopes are often cloud-covered while the top remains clear. It is a familiar sight therefore to ships far out at sea passing up the Alaskan coast, appearing distant and unapproachable. It is one of the most imposing and famous mountain views. The region was first made known by Bering, Vancouver, and La Perouse, and it is very fitting that to these names should now be added that of a modern explorer with much the same dash and adventurous nature as those who had gone before him.

St. Elias however was only preliminary to a still greater effort. The attempt to reach the North Pole from Franz Josef Land is one of the landmarks in Arctic history. Determined efforts to reach the Pole date back to Parry's voyage in 1827, and at the end of the century the honours rested with Nansen, who had reached 86° 5′ N. in 1895. The experience of all earlier expeditions was hardly in favour of a successful sledge journey across the Arctic pack-ice. Not only the English failure in 1876, but also Nansen's rate of travel, were all against success from a distant land base. The choice of Franz Josef Land was therefore a bold one, but it was followed by a still bolder decision when the Duke ordered his ship up British Channel to Prince Rudolf Island in the extreme north of the Franz Josef archipelago. This was more than 100 miles north of the coasts usually reached by ships in this region. It was a big risk to take; and the *Stella Polare* was in fact nipped by the ice and partly crushed, and even for a time abandoned, though only temporarily. Had it not been however for the bold decision to take these risks with the ship, the expedition might merely have added one more to the number of those which have gone to Franz Josef Land and made no mark. The base in the far north of the archipelago effectively prevented this, and made a great sledge record possible.

Everything was subordinated to an attempt to reach the Pole. Sledge parties were trained, and then most unfortunately severe frost-bite prevented the Duke from leading his men; it fell to Commander Cagni therefore to be the actual leader who carried out the well-laid plans. The first start was made towards the end of February 1900. The date chosen however was too early, and low temperatures combined with heavy loads forced a return after the second day's march. Loads were reduced, sledges adjusted, and a final start made on March 11.

Pressure ridges and rough ice prevented much progress during the first fifteen days, and the drift of the ice was continually against the party; during this time the distance gained in latitude was no more than an average of 4 miles a day, although many more miles were being covered on the ground. The weather remained intensely cold and the pack-ice gave them a full measure of disappointing days among hummocky ice alternating with stretches of surprisingly good surface, but with the former largely predominating. The last supporting party was sent back on March 31, Cagni making a wise decision to increase his final party from three men to four, and to take more sledges but with lighter loads. This elasticity in plan and ability to make a quick change must be regarded as an important factor in the ultimate success. The surface of the ice improved and very rapid marches were made, averaging as much as 10 miles a day. Finally Nansen's record was broken and the farthest north reached on April 25. This was in lat. 86° 34′ N.

On the return journey difficulties accumulated: the rise in temperature as summer advanced and the unexpectedly strong westward drift of the ice-pack combined together to make numerous water lanes, which remained open. The party was not only held up and delayed, but was also driven more and more to the west. Their provisions ran out, and it was only by a turn of fortune and good leadership that they were finally able to land once more on Franz Josef Land, though many miles from the base on Prince Rudolf Island.

The Italian record is one of the outstanding features in the history of polar conquest. The distance travelled over Arctic pack was longer than that of any previous expedition, and the rate of travel was often almost double that of Nansen. The leader was quick to see the full significance of this success. Sledging on the Arctic pack had lost its terrors, and the Duke claimed that the Pole could now be reached, but preferably from the most northern land base possible, namely, in Ellesmere Land. Many would like to have seen him take a second expedition along this latter route, and must regret that Italians did not profit still further by the knowledge gained by their countrymen. As it was, for a second time without previous experience of the particular methods necessary success had again been achieved; and on both expeditions an example was set for others to follow; St. Elias pointed the way in Arctic mountain exploration, and the Franz Josef Land expedition showed surely and clearly how the North Pole itself could be reached and won. Neither expedition however would, I think, have been possible had it not been for the Duke's own foresight and ability to learn from his predecessors and to profit by their difficulties and failures, so that in his hands the same methods overcame the difficulties and led to final and certain success.

Sir HALFORD MACKINDER: I must now ask you to move your minds from the Pole to the Equator. In his glowing tribute to his great compatriot, Professor Dainelli has reminded you that the Duke of the Abruzzi has left his name in not fewer than five widely separate arenas of discovery. The Duke was happy no less in the time than in the fortune of his birth. The map of the world was then like a rose-bud just spreading into full bloom; in the newly seen hollow of each petal there still hung an aroma of mystery. Mystery and not ignorance is the right term to apply, especially to the African petal.

The old tag was that there is always something new coming out of Africa, but would it not be equally true to say that there has been nothing really new out of that land of rumour? Were not the Greeks aware of the Pygmies, and did not Aristotle write of the Mountain of Silver at the source of the Nile? It was inevitably so of a continent where every chieftain who comes into *shauri* with you is ready to illustrate his argument by drawing a map on the ground with his stick; he has a far better topographical sense than had most of the schoolmasters of my youth. It was the sceptical eighteenth century which cleared the mirage from the heart of Africa and left it void and blank on our maps, with the curious result that in the nineteenth century, the heroic age of African travel, we were more or less deaf to the meaning of what the natives were telling us. In this very Society, in the fifties, there was frequent debate as to the eye witness even of white men; for several years it was contended that Kilimanjaro and Kenya were the malarial illusions of the missionaries who claimed to have seen them. Thus it happened that when in 1864 Sir Samuel Baker, afloat on Lake Albert, saw some vague shapes in the mist of his southern horizon, his imagination was not stirred, and he wrote on his map the commonplace name of Blue Mountains. Eleven years later, in 1875, Stanley camped at the foot of these mountains and recorded without comment in his diary what the natives said to him of the whiteness and cold of the peaks near by, hidden in the clouds. In 1876 the Italian Gessi, as Professor Dainelli has told you, saw a vision in the sky as of mountains covered with snow, but wrote it down as a hallucination.

At last, in 1888, when on the southern shore of Lake Albert, Stanley had his attention drawn by a native boy to a mountain said to be covered with salt. He tells us that what he saw was a peculiar shaped cloud of a most beautiful silver colour. Following its form downward he was struck by the deep blue-black colour of its base, and then as his sight descended to the land shapes below he became for the first time conscious that he was gazing, not at the semblance of a

great mountain, but at the solid substance of one, with its summit covered with snow. And he gave it the name of Ruwenzori, by which he judged it to be most often known in the district around. In the next year, 1889, he saw it on several occasions. He sent his companion Stairs to examine it nearer, and Stairs got within sight of peaks which he estimated as being 16,000 feet high.

Half a generation then elapsed, during which several explorers visited the slopes and one or two reached the glaciers. But not until the Uganda Railway had been built, and the region had been pacified by British administration, did it become practicable to take out a properly equipped mountaineering expedition. Several parties were awaiting the opportunity, and there was something like a race to seize it.

In the autumn of 1905 our now venerable ex-President, Douglas Freshfield, of Caucasus fame, made the attempt with Mumm, a brother member of the Alpine Club; but unfortunately they had been wrongly informed as to the seasons. Ruwenzori, just north of the Equator, has rains at all times of year, but they are torrential in the spring and autumn. Though he had to turn back, Freshfield added to that gallery of word-pictures from many parts of the world, which will be his legacy to posterity, some delightful vignettes of Ruwenzori scenery and vegetation. Within a few months, in 1906, a British Museum expedition was on the spot with Wollaston, another member of the Alpine Club, but he in turn was mainly defeated, this time by the spring rains, though he climbed a peak of 15,000 feet.

So it happened that the way was left open for the Italian achievement. Never was success better deserved. Nothing had been left to chance. Not only had the summer season been rightly selected, but preparation had been made on a scale and with a thoroughness that at that time were almost unexampled in land exploration. Perhaps I may be forgiven for mentioning a point of interest to myself; of the two Alpine guides and two Alpine porters, all from Courmayeur at the Italian foot of Mont Blanc, one guide, Cesar Ollier, and one porter, Joseph Brocherel, had been with me six years earlier on Mount Kenya, and I have reason to remember their tenacity and competence.

The expedition was away from Italy from April to October. It went up the Uganda Railway and across Lake Victoria by steamer. Through Uganda to Fort Portal, on the brink of the Semliki Valley, the advance was by time-honoured *safari* with human porterage, for there was as yet no motor transport in Central Africa. The work of exploration was based on Fort Portal.

Kilimanjaro, Kenya, and Ruwenzori cover about the same areas; each of them rises from foundations about as large as the county of Kent, but while the two former are extinct volcanoes, Ruwenzori is a short but lofty true mountain range, a raised and domed block of the Archaean floor of the African Plateau. Salient from the hard gneissic and schistose massif are six yet harder blocks, each a couple of miles or so in diameter; they may be compared to diamonds set in a metal brooch. Each of these blocks again is jagged into from two to five peaks as high as or higher than the Mont Blanc of the Alps. The summit of them all measures 16,800 feet and was named by the Duke after Queen Margherita of Italy. The second highest he named after Queen Alexandra of England. In all there are, within a circle of 10 miles diameter, about a score of separate points over 15,000 feet, and of these three-quarters were climbed to the top by the expedition. So completely was the work of survey done that there has remained little more than detail to be filled in by successors.

In the following year, 1907, a memorable meeting of our Society was held in the Queen's Hall to hear the Duke's account of his journey. For the first time in our history, our Patron, the reigning Sovereign, King Edward VII, presided,

and it was at his request that one of the six groups of the peaks which crown Ruwenzori was named Luigi di Savoia, Lewis of Savoy, being the princely title of the Duke of the Abruzzi.

Lord CONWAY OF ALLINGTON: I took a special interest in the Duke of the Abruzzi's Expedition in 1909 because a considerable part of his route lay over glaciers which I had explored in 1892. His expedition was, of course, far better equipped than mine. He added to our knowledge by the survey of an important area around K_2, and he brought back a number of admirable photographs of the great mountains surrounding the Baltoro Glacier. Most of those mountains, as every traveller who has visited that region must realize, are hopelessly inaccessible to climbers, but we did succeed in identifying two which offered some possibility of success. I named them the Golden Throne and The Bride. We had forced a way up to the head of the glacier where a great snow-field, attained by passing through a wide ice-fall, could be traversed to the foot of both peaks. After examining the whole neighbourhood the Duke decided to make an attempt on The Bride. That is a white pyramidal peak, which presented no inherent difficulty in its structure beyond those of size and distance. After a great struggle the Duke and his party, who had attained to a height of over 24,000 feet, thus easily beating the then existing record for altitude, were forced to return without actually attaining the summit. Of course the hoped-for goal of the expedition was to make an attack on K_2. Prospecting parties examined that mountain on all sides, without finding a breach in its defences. It has a prominent ice-arête rising from a col at the south foot of the mountain. Every yard of this ridge could probably be traversed, taken bit by bit; but how could anybody spend two or three nights, which might be necessary, on such an icy perch in a region buffeted by frequent gales of terrific force? The completeness of the exploration of the parts examined or traversed by the Duke's party might be cited as a typical example of first-rate geographical work. All the exploratory work he did was of this kind. There was nothing slovenly about his methods. He chose the best men to go with him, and he gave them the most admirable support. He possessed the faculty of inspiring his followers, and whether it were on the Arctic ice-pack, in the wastes of snowy Alaska, or on the sodden slopes of Ruwenzori, he sustained the morale of his men and infused into them his own enthusiasm. As far as the Karakoram was concerned, his work was continued in the same spirit by his relative, the Duke of Spoleto, whose interesting account of his expedition will be remembered by the Fellows of this Society. At the knot point of the ranges, which come together east of The Golden Throne and Gasherbrum, there still remains some important survey work to be done. The explorer who discovers and traverses the pass at the head of the Baltoro Glacier and thus makes connection with the parts already surveyed by Dr. Longstaff and his companions, will, I think, have revealed what for grandeur of scenery may probably be the finest glacier pass in the world.

However this may be and however many later explorers may add their labours and their interpretations to work already begun and partly done, the work of the Duke of the Abruzzi will ever remain a permanent part of the exploration of this part of the world, and his name will always be associated with K_2 and its surrounding peaks.

The PRESIDENT: We are honoured to-night by the presence of the Italian Ambassador, and we shall be very glad if he will say a word or two to us.

H.E. THE ITALIAN AMBASSADOR: I wish to say only a few words to express the sincerest thanks of the Italian nation, which I have the honour of representing here, for the very warm and the moving tribute of sympathy which has been paid this evening to a Prince of the Italian Royal Family, the Duca d'Abruzzi. I par-

ticularly wish to thank the President of the Royal Geographical Society for the kind thought he has had in inviting us here, and I also thank Lord Conway, Sir Halford Mackinder, and Mr. Wordie, besides my countryman, Signor Dainelli, for the very remarkable speeches they have just made.

For many years I had the honour of personally knowing and often meeting the Duca d'Abruzzi, and perhaps no one is better able than I to say how fond he was of this great country and how many excellent and faithful friends he knew he had here in England. Our meeting here to-night is only a new proof of this. As a Prince, as an explorer, and as a soldier our beloved Duca d'Abruzzi had always constantly in his mind to bring about an ever more intimate understanding and co-operation between our two countries in every field of endeavour, that he might further the welfare and progress of humanity. I am sure it would make him happy to see us, his faithful English friends, and his devoted countrymen, assembled here to honour his memory, which will remain alive for ever. On behalf of my countrymen I wish to thank you again, with all my heart.

The PRESIDENT: I beg that Your Excellency will be assured that the words that you have just spoken to-night are deeply and most sincerely appreciated by the Society over which I have the honour to preside. Those words will be printed in the account which will appear in our *Journal*, so that they will not only be heard by this audience but will be read by all the Fellows of the Society.

Your Excellency and all here have heard four men, each eminently qualified by experience and performance, speak of the work of the Duke of the Abruzzi with unstinted praise and admiration. I am not a mountaineer nor a Polar explorer, and I would like for one moment to speak of His Royal Highness as a brother officer, if Your Excellency will allow me to call myself so, and as a man.

It was my fortune to have some slight acquaintance with His Royal Highness some years past, and as soon as one got past that slight appearance almost, as Professor Dainelli has said, of austerity one saw how warm and sympathetic his heart was to all those who genuinely believed in what they professed. We in the British Navy have sent many officers, and men too, on Polar explorations, and the fact that H.R.H. himself was a seaman, taking seamen, both officers and men, with him, makes an additional link between our Services.

Did you notice the comparison which the Professor made? The seaman and the mountaineer. About two years ago it was my privilege to speak at the Alpine Club, and I remember mentioning there how each, in their different spheres, could sympathize with the other; how the mountaineer standing at midday on the peak of some mountain in a cloudless sky could cast a thought to the seaman walking the bridge at midnight in a tropical night, and how the seaman struggling through heavy gales and seas in the Atlantic can think of the mountaineer struggling with equal determination through ice and snow to gain his desired haven. The man whose memory we commemorate to-night saw all those things accomplished both at sea and on the mountain-top. It comes to few to experience all such.

The Duke was not only a Fellow of this Society but also a member of the Alpine Club, and in both those connections one may think how interested he would have been at this moment in the great effort which is being made by Mr. Hugh Ruttledge and his party in the ascent of Mount Everest. And, with the modesty which was entirely his, how he would sympathize with the restraint with which Mr. Ruttledge makes his description as far as he has gone.

I come to the end. In all the work that the Duke carried out he had in his mind that which has so often been spoken of from this platform; what the geographer, and indeed all those who seek after knowledge have for their aim; that is what you have heard His Excellency describe as the welfare and progress of mankind.

Only this morning I had a visit from Captain Andrews who, here this evening, has just spent two and a half years with the Glovers crossing Africa. He talked to me of the work of the Duke as he saw it in Somaliland not so long ago: 6000 hectares of land under cultivation; a river diverted at one point sufficient to give a fall, with the levels and the drainage controlled by a dam and sluices; headquarters comprising a hospital, a veterinary clinic, chemical research laboratory, schools, and an experimental cattle farm where European cattle are all kept in stock. Can it be wondered, as Captain Andrews said to me, that the name of the Duke of the Abruzzi is venerated by all his staff?

The connection between this Society and the Royal House of Savoy is traditional. It is a matter of deep satisfaction to us to know, now the Duke of the Abruzzi has left us, that we have on our lists the names of the Duchess of Aosta, the Duke of Aosta, and the Duke of Spoleto, the latter of whom is a Gold Medallist of this Society.

You, Professor Dainelli, have told us of this very remarkable work of one man in a way which has caused us to be really inspired. I beg that you will accept from this audience and from the whole of the Royal Geographical Society our warm thanks for giving us an evening which has been not only a great pleasure but also a great encouragement in the activities which we profess.

PROFESSOR J. W. GREGORY'S EXPEDITION TO PERU, 1932: *Two papers read at the Evening Meeting of the Society on 1 May 1933, by*

A. V. COVERLEY-PRICE AND M. McKINNON WOOD

I. NARRATIVE OF THE JOURNEY. By A. V. COVERLEY-PRICE

THE late Professor Gregory told me that his desire to visit South America originated about forty years ago, when he was examining certain geological problems embracing that Continent, Africa, and Australia, in connection with the geological history of the Pacific Ocean. In the course of his long and brilliant career he achieved his ambition to verify his theories in regard to Africa and Australia; his journeys in those two continents are too well known to require more than this passing reference here. But, for many reasons, his projected visit to South America, in particular to Peru, was postponed until the year 1932. Peru was the last unexplored field in which he desired to work; unhappily he was not spared to return to England to publish the very important results of his last great journey.

The expedition comprised four members: the late Professor Gregory, who had planned the whole journey; Miss McKinnon Wood, who specializes in fossil collecting and had made two visits to Kenya Colony for that purpose; Mr. Tarnawiecki, a Peruvian mining engineer of Polish origin who has resided in Peru for nearly thirty years; and myself. My own connection with the expedition was fortuitous. The Secretary of this Society was good enough to bring my name to the notice of Professor Gregory, who very kindly invited me to join him. I naturally welcomed the opportunity of extending my knowledge of foreign countries and peoples, and of making water-colour sketches in a little-known area of South America, so I applied to the Foreign Office for leave to join the expedition immediately after my transfer from His Majesty's Legation in Mexico City. My leave was granted, and I set out for Lima on January 9, making the voyage from Veracruz in seventeen days in three different ships, *via* Havana, Cuba, Kingston, Jamaica, and the Panama Canal.

Professor Gregory and Miss McKinnon Wood arrived from England about a fortnight after I reached Lima, and we were joined there by Mr. Tarnawiecki, who came from the north of Peru. After the Professor's arrival, we spent four busy days making final preparations for our journey, and visiting local authorities, museums, and points of geological interest. The Peruvian authorities were most kind and helpful, and we were given maps and much useful information by the Peruvian Corporation, the School of Mines, and other bodies. On February 14 we left Lima by car and drove southwards into the desert area, our field of operations for the next month.

The work of the expedition lay in three distinct regions, in each of which Professor Gregory had problems to solve. The first area to be visited comprised the coastal cordillera and the desert region lying along the coast south of Lima. The second area covered the central section of the Peruvian Andes, through which we made the first geological traverse. The third area comprised the eastern face of the Andes where they rise from the Amazon plain, as seen from

the rivers Urubamba and Ucayali. I will deal with our journeys through each of these areas in turn.

For several hundred miles south of Lima the coastal area consists of true desert intersected at intervals by the beds of rivers whose waters seldom reach the sea. Some miles from the sea the foothills of the Andes rise, a succession of bare rocky spurs apparently devoid of vegetation. The coastal belt is practically rainless, but rain falls in the mountains during the summer months and is usually sufficient to irrigate the narrow strips of cultivated land bordering the river channels. Beyond these green ribbons, varying in width from a few yards to 2 or 3 miles, it is difficult, if not impossible, to find water. The transport of an adequate supply of water was therefore one of our initial difficulties. We thought at first that we would only be able to penetrate into the desert by transporting barrels of water on the backs of mules or donkeys. Fortunately we found that we could explore rapidly and successfully by motor car, carrying sufficient water for ourselves and the cars in a lorry; and, though our progress was sometimes hindered by soft sand, we achieved our object in shorter time than we had anticipated.

We drove from Lima to Pisco in three days, spending some time on the way to examine the geology of the neighbourhood of San Vincente de Cañete and Chincha Alta. The road took us southwards parallel to the coast, sometimes along the shore itself. Shortly after leaving Lima we passed the ruins of Pachacamac; we sped across bare wind-swept stretches of pampa overlooking the sea, crossed river-beds by small bridges or rock-strewn fords, and wound our way through arid valleys among mountains of crumbling rock. The greater part of this coast-line consists of high cliffs of sedimentary rocks containing marine fossils. Near Pisco, a little port about 20 miles north of the Paracas peninsula which we made our headquarters for a week, we first saw the mass of white chalk known as the Pisco formation.

During the greater part of the year the river courses which intersect the desert area are completely dry; in the rainy season water flows in them for a few weeks, but it rarely reaches the sea, being used for irrigating the farms in the green belts along the river banks. The Ica river, from a point some distance above the town of Ica down to the sea, had contained no water at all for the past five years, and only very little six and seven years ago. The cotton plantations had been ruined, not only along this river but along others also. This year however, when our calculations were based to some extent on the absence of water, very heavy rain fell in the mountains, and even in the towns lying between them and the sea. The rivers soon flowed to their full capacity, and muddy torrents carrying boulders of considerable size poured into the sea all along the coast. At several points the river beds were unable to contain the flood, with the result that water rushed down the hills by unaccustomed routes, carrying boulders and trees and spreading destruction amidst the cotton fields. Bridges built for the normal annual flow were swept away or turned by the water, and for many days the towns of Pisco and Ica were cut off from Lima. For a time even communication by air with Ica was impossible, for the flying ground was on the side of the river remote from the town, and no traffic could pass. Fortunately for us, the main bridges on the routes from Lima did not fall until after we had passed them; though, in at least one case, a bridge

collapsed only a few hours after we had driven across it. The lower reaches of some of the rivers have no bridges at all, because, in normal times, water flows for a very short time and they are easily fordable. On February 21 when the road to Lima had been cut in several places, water overflowed into the streets of Pisco.

Our main field of desert exploration lay in the Department of Ica, where we spent about five weeks. Our object being to examine the geology of the Paracas peninsula and of the desert between the mountains and the sea, we made our headquarters in the little towns of Pisco, Ica, and Nazca in succession. Travelling by motor, sometimes with a lorry in attendance to carry supplies of water and petrol, and sufficient equipment to enable us to bivouac for an occasional night or two in the desert, we covered a good deal of ground and obtained much interesting geological information.

The Paracas peninsula is a region of hummocky desert, steep cliffs, shifting sand-dunes, and hills of outcropping rock. South of the Paracas peninsula the desert presents to the sea a long wall of cliffs of sedimentary rocks, varying in height from 50 to 200 feet, except where a few dry valleys descend to the coast. There are three large bays, all of which we visited. The biggest is Independencia Bay, over 15 miles in length, on the coast west of Ica. Farther south San Nicolas Bay and San Juan Bay are close together. Here the inland plateau descends to the sea in two or three enormous steps which apparently indicate successive changes in the level of the land. Inland the whole area is undulating desert, very dry, very hot, and often very windy. In many parts hills of ancient rock project from the sand, enclosing shallow basins or deeper valleys where the sand is smooth and hard. There are also several extensive and comparatively level areas, known as *pampas*, where hard sand sprinkled with rock fragments alternates with soft patches through which it is almost impossible to pass in a motor car.

In the desert west of Nazca we searched for and found a mountain mass known as Monte Criterion, marked on the Admiralty Chart as 5800 feet. The height of the "eight-toothed ridge," to which we climbed, as determined by aneroids, checked by boiling-point determinations at Nazca, was only 3250 feet. This was not actually the highest point in the group, two summits seen to the west being slightly higher, but still falling very far short of the Admiralty estimate. I understand that the mountain had not been visited before, and that the only known observations were those taken from the sea by the officers of H.M.S. *Beagle*, during that ship's famous voyage more than half a century ago.

Nazca, our final headquarters in the desert area, was also the starting-point for our journey across the Andes. This small town of mud houses lies in a river valley among the foothills, which stretch out in very long diminishing spurs into the sandy desert. We made many excursions in the neighbourhood and obtained excellent panoramic views of the area from the summits of the bare rocky hills overlooking the valley. Normally the wide bed of the river at Nazca contains a shallow stream flowing amongst boulders, and it is so easily fordable that there is no bridge. Heavy rains in the mountains farther inland however brought the river down in flood, and we frequently had difficulty in wading across on foot to the opposite bank.

The majority of the valleys in the desert region are filled with rock debris

Valley of the Pisco near the village of Humay

(This and the next three pages of plates are reproduced from water-colour sketches by Mr. A. V. Coverley-Price)

Mount Criterion, looking west from bivouac in the desert

which has fallen from the long jagged spurs on either side. This debris lies spread more or less evenly over the valley floor, sloping down gently almost from the valley head and extending into the plain. It is difficult to convey an accurate idea of these vast and rather flat alluvial fans; perhaps they can best be described by likening them to petrified rivers.

Owing to the fact that motor transport has replaced mule transport near the coast, our stay at Nazca was prolonged to three weeks. Having made further efforts to obtain mules locally, Mr. Tarnawiecki was obliged to travel four days inland to Lucanas where, after waiting several days, he collected nineteen mules and a muleteer. The latter however was as obstinate as the former, and only consented to bring his mules down to Nazca because Mr. Tarnawiecki threatened to shoot him if he did not do so.

Before leaving the coastal region I must not omit a brief reference to the condors. Before I went to Peru I had always believed that the condor, sometimes referred to as the Monarch of the Andes, was only seen inland amongst the very highest peaks. My experience has taught me otherwise. All along the coast I saw many condors, sometimes as many as twenty at a time, wheeling loftily above my head or sweeping majestically seawards from the precipitous cliffs. Occasionally, when I was sitting sketching, they would circle not more than 50 feet above me, and I could hear the wind vibrating their feathers like the hum of the stays of an aeroplane. In the high Andes I occasionally saw eagles, but I very rarely saw a condor.

I need only add that, as a result of Professor Gregory's work in the coastal region, that area on the geological map of Peru, hitherto a yellow patch, now wears a coat of many colours.

On March 20 we said good-bye to Nazca and the problems of the coastal region and turned our faces towards the high Andes. When referring to the main mass of the Andes the natives in that part of Peru always speak of the *Sierra*, as opposed to the densely forested lower slopes where the eastern foothills merge into the Amazon plain, which they call the *Montaña*.

While at Nazca we heard many discouraging reports about the state of the trails leading into the Sierra. Our objective on this next span of the journey was Cuzco, and we originally intended to follow a route through Castrovirreyna and Ayacucho. Continuous rain however rendered this route entirely impassable, and we therefore decided to try a line farther south. Our head muleteer signed a contract to take us as far as the village of Cabana in the Department of Ayacucho, but he refused to commit himself beyond that point. He had never been to Cuzco. The first stage of our journey was thus more or less clear; the second stage depended on muleteers, mules, and rainfall.

My original ideas about the Andes were founded on descriptions and paintings which depicted them as lofty, rugged chains of mountains of bare inhospitable rock and tremendous snow-clad peaks surrounded by clouds and condors. My first sight of them, from the Central Railway of Peru, corroborated this impression, though there were rather fewer condors than I had been led to expect. The Andes as we saw them along our line of march from the coast to Cuzco are altogether different. The foothills on the Pacific coast are long spurs running roughly east and west. They are desert mountains, almost devoid of vegetation, with occasional green ribbons in their valleys. Then come a series

Mount Criterion, looking west from bivouac in the desert

of gigantic steps, each many miles in depth, with a fairly heavy rainfall and a covering of green pasture. Then—I am speaking in very general terms—there are a series of valleys running roughly north and south, separated from one another by very high ranges of mountains, usually clad in grass except in the deeper valleys, where the vegetation is sub-tropical, and on the highest peaks, where there is snow. In the midst of this mountain system there are vast high plateaux, similar to the steps leading up to them, but very cold and damp. These plateaux are the home of the llama, the huanaco, and the vicuña. Beyond Cuzco the mountains drop gradually, until their lower slopes are swamped in the jungle of the Amazon plains.

We started our journey in February when the coast was dry and hot and the skies of Lima were clear. Meanwhile, in the high Andes, an abundance of rain was falling, which gradually eased up with the approach of winter. Later in the year Lima lies shrouded in an unpleasant, damp mist, while heavy snow falls in the Andes and temperatures at the higher altitudes are very low.

This central mass of the Peruvian Andes appears to have been a high table-land, raised in remote ages from the bed of an Andean sea, which has been gradually carved down by rivers. Nearly all trace of the primary rivers, which probably flowed north and south, has disappeared, but remarkable hanging valleys show clearly the later stages of denudation. The skyline, as one looks from a height over a magnificent panorama of mountains and valleys, indicates the level of the original plateau; and although the country is so very deeply carved, a typical view would show a horizontal skyline at the level of the highest peaks. Range after range of mountains lay between us and our objective, and our journey was a series of tremendous ups and downs, relieved occasionally by a long trudge over a cold and swampy plateau. Where the ground is at all flat it is generally wet; any other kind of ground is a bumpy, rocky slope. I think it is true to say that we did not once pitch our tents or make our bivouac on really level ground.

When we left Nazca we at once began to climb, and our route eastwards lay for a long time in the rocky bed of a river, which we crossed and re-crossed many times, wading through the water. The continental divide is comparatively near the west coast, and the rivers flowing into the Pacific Ocean are mostly short and swift. This river was no exception. Recent rains had formed a torrent like an avalanche, and much of the track had been completely obliterated by enormous boulders, some of them 10 or 12 feet in diameter, which had been brought down by the flood. Unless you have seen it, it is hard to believe that boulders of such size can be rolled along like marbles in the bed of a stream. We saw some that had been freshly splintered by the force of impact against other rocks.

Among the debris of landslides, stricken trees, and huge boulders our nineteen mules, half their number loaded with our baggage, food supplies, and instruments, struggled up to the first plateau or step of the Sierra. Here we found coarse grass, scrubby trees, and a few wild flowers which seemed fragrant beyond belief after our weeks in the waterless desert. In spite of the rain, there was very little water to be found as yet, and the pasture was not good. So we pushed on upwards, surmounting another step or two, until the early evening. Our tents went up as the sun went down behind the mountains of sand, which

The Andes near Cabana, looking north

Palo Santo rapids in the Rio Urubamba

Entrance to the Pongo de Mainique, near the junction of the Urubamba and Yuyato

we could see far away below us, half hidden by the greener foothills through which our route had lain. The Pacific Ocean was barely 60 miles away.

During the first few days we had considerable difficulty with the pack mules, for, not being accustomed to their loads, they constantly bucked them off. Several of them were lame after their journey through the river bed and over the rocks. Although we usually got up with the sun, before six o'clock in the morning, an early start was frequently delayed owing to the mules having strayed in search of water. Our day's march varied in length from 10 to 20 miles, depending on the character of the country and the amount of geological work to be done on the way. Our camping grounds were usually determined by the presence of water and pasture. On the second day we made a longer march than we had intended, but eventually found some brackish water in a gulley at 9000 feet. Beyond this point the pasture improved, and we could nearly always be sure of finding water at intervals along our route.

We then entered a volcanic region where thick layers of ancient lava lay horizontally one on top of another, forming a series of steps or shelves along both sides of the valleys. Sometimes we counted as many as five or six such layers—a very distinctive feature of the landscape. They appeared to have been little disturbed by earth movements, but the mountain streams had carved deep valleys, leaving long ridges of lava, sometimes 200 or 300 feet in height, jutting out into the undulating plateau like the fingers of a hand. Several of these valleys were freely spangled with yellow and white flowers, and brightly coloured lichens clung to the fallen boulders.

Thus by a series of uneven steps we gradually climbed to the Puña—the word used in central Peru to indicate the high plateaux lying at an altitude of 10,000 or 12,000 feet in the midst of the main mountain system. These plateaux are not necessarily flat plains, they are more often areas of rolling hills and long shallow valleys, alternating with broader expanses of grass land, also known as *pampas*, where the mountains recede several miles.

The puña has three main characteristics. It is grassland, and often provides good pasture for large herds of llamas. It is damp underfoot, owing to heavy precipitation from the low-lying clouds. And it is cold on account of the altitude, the winds sweeping down from the higher snow peaks, and evaporation. Here, at least, there is no lack of water. Sluggish streams meander across the more level areas until they reach the edge of the plateau, when they join together to form mountain torrents and plunge down towards the warmer valleys. Some of the streams are snow-fed; others drain the surrounding hills. When the sun penetrates the clouds a pleasant warmth is felt; but at other times the air is cool, or even cold. I am now speaking of March and April. I believe that later in the year the cold is intense. When the wind blows, the traveller envies the llamas in their very thick coats of wool.

The puña is subject to sudden squalls, like the squalls that are met at sea. The sigh of the wind immediately precedes a heavy downpour of driven rain, and very often of hail. For a short time visibility is shortened to a few hundred yards or less; then the squall passes over and may be seen, an isolated wall of water of measurable dimensions, moving away across the plateau. There are practically no trees or even shrubs on the puña, but a number of wild flowers may be found. Practically no one lives there, though a rare shepherd sometimes

bivouacs on the lonely waste while he is moving a flock of sheep. In a few of the high valleys there are considerable herds of llamas, and smaller numbers of huanacos and of the very fleet and graceful vicuñas. Bird life is not abundant, but some of the ponds and small lakes at these high altitudes are the haunt of wild duck, flamingoes, and a few geese.

When travelling over the puña you hardly realize that you are in the midst of a vast mountain system. Such areas might be plains almost at sea-level, shrouded in the mists of autumn and surrounded by hills little higher than the Sussex Downs. Until you make a physical effort, and feel the effect on heart and lungs, it is difficult to realize that you are travelling at an altitude of 12,000 feet or more. But when you have surmounted the hills on the rim of the plateau, you become aware that you are on the top of the world.

One day, from such a point of vantage, we looked down on a magnificent panorama of humped hills, flat-topped pyramids, and truncated cones, and ramparts of grey lava carved into columns of immense thickness like the turrets of a fortress. From 14,000 feet the ground fell away to the floor of a deep valley 6000 feet below. We had to make our way down the steep slope among large boulders, tufts of coarse grass, and patches of greasy mud; wade through the swiftly flowing torrent in the valley, and immediately begin another long ascent. Up and up we went until we reached the puña again. Thus we continued, alternating between the high plateaux and the deep valleys; between the cold air and hailstorms, and the warm sunshine and subtropical vegetation.

We reached the continental divide six days after leaving Nazca, having spent one whole day in camp at an altitude of rather more than 12,000 feet in order to rest the mules. The halt gave us all an opportunity to do some work. I did some sketching, and also bagged a brace of duck and a goose weighing 15 lb. at a small lake near our camp.

Before reaching the continental divide we waded, with the water nearly up to the saddles, through two mountain torrents, the Lleyllusa and the Acari, and then descended into a gigantic volcanic vent several miles in width. As we climbed up the far side of this vast basin, at first over gently sloping alps, then up a far steeper gradient, the mules began to show signs of distress. Numerous rills of sparkling water meandered through the stubborn grass; the air was cold and exertion made us pant hard, for we were approaching the highest point on our whole journey. On these high slopes there were signs of glacial action, and short coarse grass was growing almost to the top. We crossed the divide at about 16,100 feet, pursued by tremendous banks of clouds, and descended into a long shallow valley where we camped for the night at 15,000 feet. A strong wind brought heavy hail and rain down upon us while we were unloading the mules, and the following morning, Easter Day, the ground was covered with a thin layer of frozen snow. This was not a good place for a halt, even though it was Easter Day; so we decided to push on to Cabana, a village lying in very beautiful surroundings at an altitude of about 11,000 feet. On the way there we passed many large herds of llamas, and we obtained our first view of a magnificent range of snow-clad mountains known as the Nevado Carhuarasa.

We reached Cabana after a gruelling descent of several thousand feet, when darkness had already fallen, in the midst of a heavy thunderstorm. On the way

down the vegetation changed, and various kinds of cacti, wholly absent from the higher regions, had become abundant by the time we sighted Cabana. Here our contract with the muleteer terminated, and here we remained for three and a half days, four of us living amongst our baggage in an unfurnished two-roomed mud hovel. In spite of our primitive surroundings we were each able to put in some useful work. Our rooms were pitch dark, so I usually finished up my water-colour sketches sitting in front of the house, which faced the Plaza. I always had an audience. From 6 a.m. until 6 p.m. a good proportion of the inhabitants of Cabana stood with gaping mouths around our front door. They were thirsting for entertainment, and they got it. For which of them before had seen an elderly Englishman boiling a thermometer, or a Señorita in riding breeches breaking stones with a hammer, or a bearded individual painting a picture of their own delightful metropolis?

By intensive argument, and the bait of unknown Cuzco, our chief muleteer was induced to sign another contract to take us on to our next goal. Most of the route was unknown to him, and local rumours about the bandits liable to be met on the way were so terrifying that he had the greatest difficulty in obtaining the three assistants he required. His original *compañero* refused to go a step farther, and one youth was dragged from our clutches at the last moment by his awe-stricken mother. Eventually however we got our crew together, one of our muleteers being the governor of Cabana himself.

The journey from Cabana to Cuzco took us eighteen days, including two or three days spent on the way to rest the mules. We were now in a region of high mountains and deep valleys: the loftiest peaks were clad in eternal snow and thrust their heads into the clouds more than 20,000 feet above the sea. This region covers the Departments of Ayacucho, Apurimac, and Cuzco. The population of these three Departments is approximately eighteen, thirty-four, and thirteen inhabitants respectively to the square mile. A considerable proportion of this population is concentrated in a few towns like Ayacucho, Abancay, Andahuaylas, and Cuzco; the rest is distributed among a number of small villages scattered over the area. Nearly all these villages are on or near rivers, and are therefore found in the valleys with a subtropical climate. A few villages lie at higher altitudes, up to about 12,000 feet, and Cuzco itself is at 11,000 feet. Outside these centres of population the only signs of human life we saw were occasional natives, wrapped in their ponchos, with strings of mules or donkeys carrying salt, sugar, or coca-leaves to Cuzco.

Our line of march took us through several of the Andean villages, and we spent a night or two in some of them. The houses are built of mud and stone; they are easily washed away by heavy rain, but equally easily rebuilt. The inhabitants, whose staple food is maize and beans, do a little farming, and sometimes own small flocks of sheep and herds of cattle and llamas. They are a stocky, hardy race, accustomed to making long journeys on foot over the trails through the Andes, for the markets are few and far between.

Immediately after leaving Cabana we descended more than 2000 feet to the village of Sondondo, which lies on the floor of a valley, perhaps half a mile in width, with cliffs several hundred feet in height forming vertical walls on either side. We crossed the river Sondondo by a rope suspension bridge 150 feet long and 6 inches wide, while the mules waded or swam across. Next day we

were up within sight of the snow-line again, and the winding river looked like an insignificant ditch in its canyon nearly 6000 feet below us. Thus, by a series of tremendous climbs and descents, we passed over one range of mountains after another on the way to Cuzco. The deeper valleys were often warm and sunny, with babbling brooks and mountain torrents tumbling over the rocks in the early stages of their long journey to the Atlantic Ocean. There were many wild flowers and cacti, sometimes in such profusion that the mountain side looked like a rock garden. Now and then, when our line of march corresponded with a side valley, we travelled for an hour or so up or down a less steep gradient. But whenever we reached the top of a pass we saw before us an apparently unending succession of high ridges, and over these we had to continue our journey.

On April 2 we reached Querobamba, a village lying at an altitude of about 11,800 feet. We were obliged to spend two nights there because some of our mules escaped from their enclosure during the night and were not recovered for about twelve hours. Our muleteers tracked them for three-hours' journey back along our route to a spot where they had been held up by a landslide. We were accommodated in the municipal building of Querobamba, a mud construction facing the main square, but I would have preferred my tent. Miss McKinnon Wood slept in a dusty empty room upstairs, about 100 feet long and 15 feet wide. The rest of us, muleteers, baggage and all, slept in the open down below, underneath the balcony. The mud wall behind us enclosed the village gaol; in front of us was the Plaza, and the inevitable crowd of onlookers. It was a cold, starlit night, disturbed by the voices of children and dogs, but we slept fairly well until half-past five.

Ever since leaving Cabana our muleteers had shown signs of uneasiness at the prospect of having to pass through an area which they alleged was infested by bandits. According to their story, the bandits lie in wait on the high pampas for any passing caravan. During the night they creep up to the camp or bivouac and steal as many mules as they can lay hands on. We felt sure that this story was exaggerated, but the muleteers begged us to be ready with our arms; and their fears were only increased by the stories they heard in some of the villages through which we passed. We noticed however that no matter how far we advanced, the worst bandits were always supposed to be lurking just ahead of us. When we eventually heard of real live bandits, the circumstances which I will describe later were so unexpected that they provided a comic relief.

One of the most difficult river crossings we had to make was over the Rio Pampachiri, after a long descent from the chilly air at 14,000 feet into a warm and sunny valley. We had spent the night in a dirty mud hut in the village of Chilcayo, and had to cross the river in order to reach Chiara, another village perched on the crest of a spur. Our descent was delayed by the necessity of getting men to repair the narrow track, a section of which had been swept away by a landslide. We learnt later that the landslide was not altogether a natural phenomenon, for the villagers of Chilcayo allowed it to obstruct the trail in order to prevent the men of Chiara, who were described as desperate bandits, from coming over and stealing their cattle. The river was about 150 yards wide with a swift current, and the water reached the saddles. The

mules were led across, three or four at a time, each with two men holding on to it. I found that it was not a comfortable sensation to be sitting on a mule in midstream with my feet round its neck and the water rushing past.

In spite of rumours to the contrary we had a friendly reception at Chiara village, and passed on upwards and on to the desolate plateau without untoward incident. During the day we passed a shepherd with his flock in a high valley. The muleteers bought a sheep for a mere song, slaughtered it on the spot, cut it up, and carried the carcase off on a mule.

The scenery in this part of the Andes is very beautiful, for it is so obviously unmarred by the works of man. No railway and no road scars the mountain sides; no factory chimney belches forth black smoke in the uncultivated valleys; no power-station harnesses the vigorous young streams and rivers, and no works of masonry impede their descent to the Amazon plains. Wild nature reigns supreme. Except on the very highest peaks and on the steepest precipices, there is a coat of green everywhere. This coat of green has the effect of modifying the appearance of great altitude, making the mountains seem less formidable than mountains of bare rock. In Europe we are accustomed to a low snow-line, and find it hard to realize that a meadow spangled with wild flowers can exist at the height of Mont Blanc.

When we reached the valley of Andahuaylas, dotted with graceful Peruvian poplars, we pitched our camp close to the village of Talavera. While I was carrying baggage down to our camping-ground, the Sub-Prefect of Andahuaylas, accompanied by two soldiers and another armed official, suddenly arrived on horseback. The Sub-Prefect told me that he had received a telegram from the Prefect's Office at Abancay, the capital of the Department of Apurimac, informing him that a party of four suspicious characters, one looking like a Bolivian, carrying arms and boxes of revolvers, had entered the district *via* Huancaray and should be arrested at once and their arms taken from them. The Sub-Prefect supposed that the telegram referred to our party, but he was doubtful about making an arrest when he saw that the so-called boxes of revolvers merely contained food supplies, instruments, and geological specimens. We showed him our credentials, and when we had established our identity he thoroughly enjoyed the joke. Apparently the Governor of Huacaña had taken fright when he saw us, and had set the telegraph wires humming all over Peru. Having no other means of communication, he sent a special messenger 60 miles through the mountains to the nearest telegraph office at Puquio. The Sub-Prefect there telegraphed to the Prefect of Ayacucho, who telegraphed to the Secretary of the Prefect at Abancay, who in his turn telegraphed to Andahuaylas. We never expected, in the midst of the alleged bandit country, to be mistaken for bandits ourselves.

Close to the little town of Andahuaylas we joined the Cuzco motor road, but soon left it again and struck across the mountains by a trail. On one occasion night overtook us before we reached a camping-ground, and we had a disagreeable ride in pitch darkness down a very rough, winding track, and found that the steep mountain side, covered with rocks and scrub, afforded no room for tents. In spite of the cold, we bivouacked in the open, with kit-bags and saddle-bags to prevent ourselves rolling down into the valley.

At dawn we looked down upon a magnificent panorama. Far below us, still

shrouded in clouds, lay a valley which we had to cross that day. Beyond, range after range of tremendous mountains, silhouetted against the early sky, thrust their highest peaks up to the general level of the ancient plateau. One after another these high ranges had to be surmounted and the intervening valleys crossed. Many more awesome descents to the far-off turbulent rivers in their warm valleys, many more gruelling climbs to the chilly air of the puña, awaited us and our sturdy mules before we reached Cuzco. The way led by narrow rock-strewn paths along the brink of precipices; through sunny valleys where wild flowers of every colour beautified the rugged scenery, and where the lofty organ-pipe cactus pointed to the sky; up and up by zigzag trails where the mules stopped frequently, panting with the exertion of the prolonged climb. And behind them there were always the cries of "mula! mula!" and the eloquent curses of the muleteers.

Thus we progressed, day after day, through the majestic wilderness of the Peruvian Andes. Sometimes we passed through a remote village, sometimes we touched a small town, when it happened to lie on our route. We left Huancarama behind us, with its background of snowy peaks; we camped beside the Rio Pachachaca, where the mosquitoes attacked us from above and the prickly weeds stabbed us from below; we rode through Abancay with its clouds of biting flies; we crossed another high pass at about 15,100 feet, and camped on swampy ground in the shadow of a snowy giant known by the natives as the Cerro del Puerto. Our tents stood at an altitude of 11,000 feet, but the mountain towered high above us into the clouds. At sunset the clouds passed away for an hour, and two or three large glaciers glowed with a wonderful shimmer of pink.

On April 15 we had a particularly long day. For 20 miles along our route there was no suitable camping-ground, and the trail led always steeply up or steeply down. About dusk we descended to the Apurimac river, where colourful parrots flew screaming overhead. We crossed the river by a bridge, and struggled up an exceedingly steep climb until we came upon the baggage mules in the darkness. No water could be found, and it was too dark to go on. So we bivouacked on rocky ground amidst cacti and scrubby trees, while the muleteers stayed out to guard the mules in case they should stray too far in search of water.

At dawn we were off again, without our breakfast; but in about an hour we reached a farm where we made tea with muddy water the colour of a London fog. That night we pitched our tents for the last time, on a spur commanding a magnificent view, not far from the unfinished Cuzco motor road. By this time the mules were so exhausted that three or four of them could scarcely struggle into camp. One of them had to be unloaded and dragged up the final slope. We all dismounted and walked for some miles. We were still at an altitude of about 12,000 feet. Next day the mules were given a rest, and we all remained in camp to work. On April 18 we went on as far as the road, and drove in a car to Cuzco in less than two hours. The mules followed later.

I will not attempt to describe Cuzco and the ruins of Incan architecture that we saw during our four-and-a-half-days' stay there. It is an interesting town, lying at an altitude of 11,000 feet. I made several rapid sketches in the town, and we all spent some time sorting out the baggage, geological specimens, and

notes which we could not safely take on with us to the montaña. Having reduced our luggage to the absolute minimum, we packed the rest and sent it by train to the coast, eventually to be shipped to England. I sent back all the water-colour sketches I had made up till then, seventy-three in number.

Our next objective was a point on the Rio Urubamba, where we hoped to find one or two canoes waiting for us to take us down the river. Professor Gregory, acting on the advice of certain friends of his who knew something about the district, had written towards the end of the year 1931 to two traders, Señores Pereira and Landa, who lived at a remote spot down the river, asking them to send a canoe upstream to Rosalina, the head of navigation, by April 20. The locality of their jungle home was known as Maranquiato, the name of a small tributary of the Rio Urubamba; and the native tribe in that neighbourhood, the Machegenga tribe, was said to be able to supply the only really reliable canoe crews. In order to make doubly sure, Professor Gregory wrote a second letter from the Pacific coast, and also communicated with two or three other men who might be able to forward the arrangements.

Messages received at Cuzco, when we were already overdue at Rosalina, made it doubtful whether a canoe was on the way; and as time went on the doubt increased. Our best course was therefore to hurry on to Rosalina and investigate the matter on the spot. On April 23 we went by train to Machupicchu and slept the night under the stars in the wonderful Incan ruins overhanging the Rio Urubamba which, in this section, flows in a deep gorge with almost vertical sides. Thence we went by car down the Urubamba valley, amidst wild mountain scenery, to an hacienda at Huadquiña, where we slept in a shack built of old dynamite packing-cases. Here we obtained mules again, and pushed on down the hot valley by a somewhat dangerous track clinging to the valley wall. In the course of the journey we crossed the tracks of many landslides, one of which extended for more than half a mile. The Urubamba, fed by many mountain streams, had already become a formidable river, 30 to 50 yards in width: too swift, too deep, and too wide to ford. One evening, as we rode in the darkness, hundreds of fireflies flashed through the gloom, like the twinkling lights of a large town in the valley below us. That night was spent under the overhanging roof of a mud hut, and the next three at Quillobamba, a village in the Santa Ana Valley within sight of the majestic snow-peak, the Nevado Salcantay.

We hourly expected definite news from Rosalina, but although two or three messages reached us, they were conflicting and unreliable. So on April 29 we moved on again. We were now leaving the Sierra and descending into the Montaña. The weather was hot, the sub-tropical vegetation was gradually giving way to the tropical forests, and the mountains were clearly stepping downwards towards the plain.

At the Hacienda Echarati we met Mr. Bües, a most interesting German engineer and surveyor who had lived for many years in Peru and knew more about the district than any one else. He had been endeavouring to obtain a canoe for us, and he accompanied us as far as Rosalina in order to give us such assistance as he could. After leaving Echarati we rode on through the Upper Urubamba valley and over lower ranges of hills to a small collection of mud huts known as Kquellouna. From there we climbed away from the river and

bivouacked at an isolated hut about 2000 feet above the stream. The hut was literally swarming with cockroaches, flies, and other insects.

A long descent on foot and a long tramp through thick forest brought us to the bank of the Rio Urubamba, opposite Rosalina. In the days of the rubber boom Rosalina was a flourishing market centre; now it is lost in the jungle. A thatched roof on posts, an old coffee plantation, and a canoe worked as a ferry by two families of Machegenga Indians are all that remain. When we reached this isolated spot we found no canoe to take us down the river, and not even a message to say that it was coming. Our baggage was taken across the swiftly flowing river and dumped beneath the only roof left standing. The mules returned by the long trail to Huadquiña, and we were left without means of transport in any direction.

North of Rosalina the tortuous river curves in a big bend to the west, and near the opposite end of this irregular arc is Maranquiato, the home of Señores Pereira and Landa. There is an old trail through the jungle between the points of the arc, but this is very seldom used, and has been rendered all but impassable by numerous landslides and the invasion of the jungle. I am not at all sure of distances in that unmeasured area, but I believe the distance from Rosalina to Maranquiato by the trail is about 60 miles. By river round the big bend it is at least 150 miles.

Now, something had got to be done. We could not sit down at Rosalina and wait for a canoe for ever. After two days' delay an Indian was found who had once been over the trail through the jungle, and it was decided that he should guide Mr. Tarnawiecki and three Indian porters to Maranquiato. Meanwhile the rest of us would wait at Rosalina.

Mr. Tarnawiecki left us on May 6, and we heard nothing more of him until May 22, when we received a note brought back by the Indians. It had taken six days for the party to hack their way through the jungle trail, and Mr. Tarnawiecki had fallen down a landslide, spraining his ankle. When he arrived at Maranquiato both the traders were away in the forest cutting timber for a contract, and it required two more days to reach them. Their house is entirely cut off from civilization for eight or nine months in the year, and they had only just received Professor Gregory's second letter. The first one sent from England they never got. By mistake the letter had been dated 1931 instead of 1932, and they thought that the canoe had been required for April 1931. Furthermore, they needed all the available Indians to fulfil their lumber contract. They had therefore decided to do nothing about the canoe. Mr. Tarnawiecki persuaded them to send us the necessary means of transport at once, and having decided to assist us, they did so to the utmost of their ability. To ensure our safety they sent not one but two canoes, with a crew of six Indians in each.

Professor Gregory, Miss McKinnon Wood, and I were stranded at Rosalina for twenty-four days, and I will indicate the kind of existence we led. Imagine ten tall posts standing upright in the ground with a high thatched roof on the top. Halfway up the poles there is part of a wooden floor, reached by a very roughly made ladder. There are no walls, and the jungle has closed in all round the building shutting out the view completely. A trail leads from a Machegenga Indian hut some way off in the jungle, past the building, and on 400 yards to

Pass east of Pincos: Mr. Coverley-Price sketching

Looking west from the last camp before Cuzco: Miss McKinnon Wood and Professor Gregory at table

Pampa west of Ica: looking south-west across the valley

View from Querobamba, showing typical dissected valley

Phots. J. W. G.

the river. Such was our home for more than three weeks, where we very literally kept open house. All day long and every day tiny midges bit us unceasingly. Spiders, cockroaches, ants, and other insects found their livelihood beneath our leaky roof. Hundreds and thousands of ants, red, white, and black, swarmed along the path to the river, ranging from the size of a pin's head to those terrible biting monsters an inch long. On two or three occasions I saw snakes, one of them more than 6 feet in length. Butterflies visited our house in hundreds, and fine specimens of that lovely blue creature, the morpho butterfly, sometimes sat on my pipe while I was sketching. We often used to catch them with our fingers.

A few Peruvian families lived in isolated spots scattered about the valley, and we soon made friends with all of them. In comparison with the sturdy folk of the high Andes they seemed to have little initiative or energy. When we were not working in the shelter of our jungle villa we made long excursions by the few existing trails. I frequently went for long tramps alone, sometimes to sketch or to collect geological specimens, but latterly to find food. On such occasions I used to call at any hut I could find, and the inhabitants often dropped in to see us for half an hour or so.

Owing to an unfortunate mistake, a box of food supplies which we had bought at Cuzco was mislaid on the way to Rosalina, and our provisions were therefore rather short. The long delay at Rosalina made the situation still more serious, and the foundation of all our meals soon consisted of little more than yucca (*i.e.* mandioca) and toasted green bananas. For three weeks we took every possible step to trace the missing food-box, but without success. Every evening, when we discussed the possibility of the canoes arriving, we also speculated as to the whereabouts of the Cuzco box.

The jungle affords many strange experiences. The most unpleasant experience we had at Rosalina was when Miss McKinnon Wood and I had to bandage one of our distant neighbours who had blown his right hand off when using dynamite to kill fish in the river.

On May 26 we had our most pleasant surprise. Twelve strange figures, dressed in red robes and with their faces painted, suddenly appeared in complete silence on the path beside our house. They were the two canoe crews who had come upstream from Maranquiato in record time, in about six days. Thereafter all was hurry and bustle. The next morning we started down the river, feeling that the last long stage of our journey had begun.

Below, that is to say north of, Rosalina the river Urubamba winds its tortuous way among the densely forested foothills of the Andes, making the great westward bend to which I have already referred, and then continuing in a northerly direction. For something like 250 miles of its course, while it is still descending to the level of the Amazon plain, it is full of rapids. Some of the very worst of these rapids are near the mouth of a tributary called the Rio Sirialo, and in the comparatively narrow canyon known as the Pongo de Mainique—the Gateway of the Parrots. At this point the river makes its last great breach in the hills.

The two canoes in which we travelled with our luggage were mahogany dug-out canoes rather more than 40 feet long, about $2\frac{1}{2}$ feet wide, and nearly 2 feet deep. They were managed by their crews with very great skill, and,

Phots. J. W. G.

View from Querobamba, showing typical dissected valley

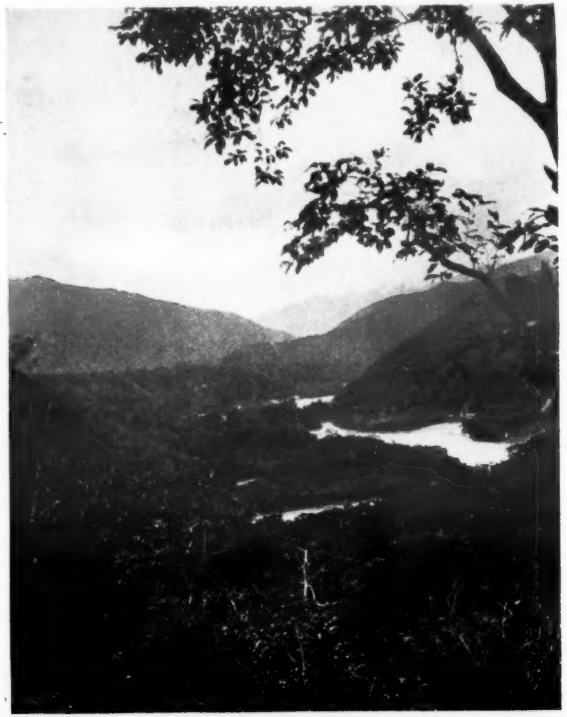
although we passed through many miles of rough water and many bad rapids, whenever it was possible we always got out and walked along the shore or over boulder banks in order to avoid the most dangerous places. On such occasions the Indians lowered the canoes over the rocks and through the turbulent water with the aid of ropes, sometimes wading breast-high in the river. In this way we travelled down the river to Maranquiato, making the journey in about four days. A good day's run was 50 miles, but we did not hurry unduly, on account of the rapids. The first night we spent at the Dominican Mission of Koribeni; the next three nights we bivouacked on sandbanks or boulder-beaches close to the mouths of small tributaries of the Rio Urubamba. We rounded the apex of the big bend on the third day. If rain threatened, the natives cut down some of the palm-like reeds called *caña brava*, also known, I believe, as the flexa plant, and in a few minutes constructed very serviceable shelters under which we slept. On the sandbanks we nearly always found the tracks of jaguars, tapirs, and other wild animals, and later on I had the good fortune to see several of these animals near the camp.

Our canoe journey had its exciting moments, when we rushed through foaming rapids in an 8-mile-an-hour current, dodging submerged rocks and whirlpools, and sometimes shipping very considerable waves. We were wet through almost from the moment we started, but we thoroughly enjoyed the experience, and reached Maranquiato in safety. We spent about twenty-four hours at Maranquiato, and the following afternoon, June 1, Señor Landa accompanied us downstream to the entrance to the Pongo de Mainique. We made our bivouac on a flat boulder island between two branches of the river. A few hundred yards ahead the stream narrowed, passing in a succession of dangerous rapids through a gorge about a mile and a half in length. Clouds hung low over the forest-clad hills, and rain fell in the evening.

The next morning, June 2, we were up as usual before six o'clock. After breakfast, we packed up and left in the canoes at about eight o'clock. Entering the gorge, we shot safely through a series of awe-inspiring rapids where more than one whirlpool lurked to catch the unwary. Then we landed on the right bank and devoted more than three hours to collecting fossils from the huge limestone boulders that formed the walls of the canyon. Meanwhile the baggage was all taken out of the canoes and carried by the Indians to a point a few hundred yards farther down the river. In addition to our crews, fourteen natives had come from Maranquiato to help us with the portage. When the luggage had been transferred, the empty canoes were lowered, one at a time, with the aid of ropes, to the new embarkation point. To reach this point they had to pass through very bad rapids, and they were both swamped in the process. I managed to secure some photographs of the scene. They were baled out and re-loaded, and we all went to the embarkation point to take our places in them. Owing to the nature of the gorge, which below this point had precipitous walls of rock, it was impossible to avoid the next series of rapids.

The canoe carrying Mr. Tarnawiecki and much of the baggage shot through the waves that were breaking on all sides and was beached, more than half full of water, several hundred yards downstream near the exit from the Pongo de Mainique. The rest of us, Professor Gregory, Miss McKinnon Wood, Señor Landa, and I, climbed into our places, and our canoe moved out into the

Vilcañota valley near Machu Picchu



The Urubamba at Rosalina

Canoe filling in the Pongo de Mainique: photograph taken from the Port of Megantone 10 minutes before the accident

Cascades in the Pongo de Mainique

current. Immediately, wave after wave pitched full into the canoe, filling it in a few seconds. We remained still, hoping that it would be swept down into calmer water, but the next moment it capsized. Miss McKinnon Wood and I managed to swim to the shore, while Señor Landa and five of the Indians clung to the upturned canoe and eventually gained the shelter of the rocks. One of the Indians, seated next to me, sank immediately in the river and never reappeared. Professor Gregory, clinging to a piece of luggage, was swept away amongst the shifting whirlpools, and in a short time he too disappeared in the rapids.[1]

After the accident the survivors were rescued from the rocks, where we were effectively marooned, by Mr. Tarnawiecki and his crew. As long as daylight lasted a search was made for the bodies of our missing companions, and that night we bivouacked below the Pongo de Mainique. The following morning it was decided that Miss McKinnon Wood and Mr. Tarnawiecki should remain at the Pongo to continue the search. Meanwhile a messenger was sent to Quillobamba, the nearest telegraph station upstream. At the same time I was to travel on down the river to Masisea, the nearest telegraph station in that direction, to send a report of the disaster to England. Travelling with the utmost possible speed, it took us each about eleven days to reach our respective goals.

The late Professor's body was recovered three days after the accident, and buried at the end of his last journey. Before closing this account of that journey, I would like to say how much I admired his tremendous energy, his remarkable perseverance, and his whole-hearted devotion to the science in which he achieved great fame.

II. Outline of the Geological Work. By M. McKinnon Wood

Professor Gregory's expedition to Peru had been a long-cherished project. Forty years ago his study of the complex history of the valley of the Red Sea and Jordan and its continuation in East Africa had led him to wonder what had happened in the Andean region at the time of the Earth movements to which the formation of the Great Rift Valley was due, and the mountain system of Peru had held a very special interest for him ever since. It was not until 1932 however, after his retirement from Glasgow University, that he was able to visit the country at a time when weather conditions were likely to prove favourable. As our journey extended from the rainless deserts of the coast, over high Andean passes, to the region of heavy precipitation on the eastern side, weather conditions were of considerable importance. It was useless to attempt to descend the headwaters of the Amazon by canoe until the floods of the rainy season had to some extent subsided, and, at the same time, we were anxious to arrive on the coast at a season when there was as much water as possible in the coastal rivers. For this reason Professor Gregory chose February for the start of the expedition.

We received a most friendly welcome in Peru, and I should like to take this opportunity of thanking all those who assisted us, both in England and

[1] I have given a more detailed account of the accident in the *Journal* for September 1932, vol. 80, p. 270.—A. V. C.-P.

in Peru, either by giving us very valuable advice, or by affording us facilities for travel.

The work of the expedition falls into three sections, corresponding to the three main geographical divisions of the country itself:

(*a*) An examination of the southern part of the coastal deserts of Peru.
(*b*) A traverse of the Andes at, geologically, their least-known area.
(*c*) An investigation of the eastern front of the Andes by descent of the Urubamba and Ucayali Rivers by canoe.

In planning the expedition Professor Gregory was primarily concerned with certain problems of structural geology, and the time at our disposal did not permit of any detailed or comprehensive survey of the geology of the region. In the accident which put so tragic an end to Professor Gregory's work, many of his papers were lost. Fortunately he had taken the precaution of sending his notes on the earlier part of the journey back from Cuzco, so that some record remains of his investigations, little as these rough notes can replace the finished work.

Before dealing with the three sections in detail, I should like to say something about the country as a whole. Geographically, the most striking feature of Peru is its mountains, which dominate the country, physically, politically, and economically, to an extent perhaps unequalled by any other country of equal size and importance. They occupy the central portion of the great Andean chain, and are of interest as forming, together with the Great Rift Valley and Highlands of Eastern Australia, the three great equidistant meridional features of the southern hemisphere. They form the backbone of Peru, and divide it into three areas of strikingly different character: the coastal deserts, the mountain belt, and the tropical plains of the Amazonian basin.

Economically the mountain belt is of great importance, not merely on account of its mineral wealth, but because upon it depends, to a large extent, the productivity of the rest of the country. The huge mountain barrier intercepts the south-east trade winds, which sweep across the warm Amazonian plains, and causes the abundant rainfall to which the eastern plains owe their almost over-exuberant fertility, and, at the same time, it acts as a contributory cause in the aridity of the coast. Nor does its influence end here, for on the western side it controls the distribution of the cultivated areas along the coast, cultivation being possible only where rivers from the Andes supply the water for irrigation, and on the eastern side it isolates the fertile plains from the Pacific ports and main centres of population, forcing them to look to the Amazonian waterways for the export of their produce.

Peru is suffering acutely from the world economic depression, and many projects for road and rail development have had to be abandoned, sometimes halfway towards completion, for lack of funds; you meet with admirably constructed bits of motor road, useless for motor traffic, as they lead to nowhere in particular, and scorned by the mule trains, which prefer the shorter, rougher trails. All three sections of the country are affected, but conditions are most striking in the montaña, or Amazonian section, where trade is at a standstill, and where, though the fertile soil yields a comfortable subsistence to its cultivators, cash is a rare and precious commodity. The only product of this region

for which there still seems to be a steady market is coca, which commands a ready sale amongst the thousands of coca chewers of Peru.

A. The Coastal Belt

To return to the work of the expedition, our first month was devoted to a study of that part of the coastal desert lying between Lima and San Juan Bay. The aridity of the coastal belt is chiefly due to the Humboldt, or Peruvian Current, which flows northwards along the coasts of North Chile and Peru as far as Punta Pariña, off which point it is deflected into the Pacific. The water of this current is so cold that the temperature of the air rises, as it passes from the ocean to the land, and its capacity for carrying moisture is increased, so that, though the winds that blow inshore from the Pacific are charged with moisture, they drop none of it as rain, but actually help to parch the lands across which they blow. This current is not invariable, and owing to its vagaries rain does occasionally fall on the coast of Peru, causing complete consternation in that land of mud architecture. The rains show a certain periodicity, lesser rains falling about once every seven years, and heavier rains occurring at intervals of about thirty-four years. The last heavy rainfall was in 1925, when it was accompanied by exceptionally heavy rain on the western front of the Andes. In 1932, seven years later, the lesser rains were about due, and, as we had noticed, from the observations taken daily on board our steamship on our way south, that the temperature of the water off the coast was higher than usual, we were not altogether unprepared for the abnormal conditions described by Mr. Coverley-Price.

The coastal desert of Peru is of two types. In the north the plains run down to the sea, terminating frequently in a steep bluff, while in the south they are separated from the Pacific by a broken chain of mountains—the Coastal Cordillera of Peru. It was the latter type of desert that Professor Gregory wished to investigate, partly in order to examine the structure of the coastal range and to determine its relation to the main Andes, and partly in order to discover the age, relations, and thickness of the younger rocks underlying the desert plains between the Coastal Cordillera and the foot of the Andes.

(i) *Desert Fans*

During the first stage of our journey, until we reached the coastal mountains, which disappear north of Paracas peninsula, we were chiefly interested in observing the effects of alternate expansion and contraction, due to change of temperature, in a desert area where the action of water is of minor importance. The downward creep of loose material under the influence of this alternate expansion and contraction gives rise to rivers of stone, varying from deep, narrow lines of stones in gullies to broad, gently sloping, river-like bands, that widen out at their lower ends to form triangular sheets, like deltas. Vibration, due to the action of the wind, no doubt plays a part in the formation of these stone rivers. No doubt also occasional storms send floods of water down the valleys, but these floods are rare, and their action, though violent, is local, so that the main descent of material from highland to lowland must be due to the constant activity of the diurnal change of temperature.

When sudden rushes of water occur their effect simulates the action of ice. The angle of repose of material under conditions of sub-aerial decay being

steeper than it is under water, the erosive power of these occasional floods in an arid region is very great. The smaller stones, on which the larger boulders rest, act as rollers in reducing friction, and astonishingly large boulders may be carried downstream, as we had evidence later on in the Blanco Valley, described by Mr. Coverley-Price. Material of different types, much of it brought from considerable distances, is deposited together in heaps, or piled up in long ridges of irregularly laid sand and boulders, which resemble the kames of glaciated regions.

In the area south of Lima two of the stone rivers frequently unite to form a confluent delta, and, when this process is repeated until many deltas have coalesced, they form a wide slightly undulating plain with a gentle slope to the sea. An illustration of this may be seen in the Pampa de Chincha Alta, between the town of that name and the foot of the Andes.

As you approach the southern type of desert there begins a long belt of younger rocks, which form level desert plains, more level and on a larger scale than the confluent desert fans to the north. Our work in this area was much facilitated by the use of motor transport, and we were fortunate in securing the services of Mr. Duncan Masson, who has had a good deal of experience in driving in these deserts, and who kindly offered to pilot our lorry.

(ii) *The Younger Rocks*

Our work in the desert belt between the Coastal Cordillera and the main Andes provided some surprises. From the current maps of Peruvian geology we had expected to find that the younger rocks of this area consisted of a thick sheet of marine deposits, let down between faults, so as to form a long rift valley parallel to the coast. From his work in this area however Professor Gregory concluded that these rocks did not form a continuous series of marine deposits, but had been laid down in a number of basins on an irregular surface of old rocks. The question of the age of these deposits depends upon the fossil evidence, and must wait until the collections of fossils have been worked out.

(iii) *The Coastal Cordillera*

In order to understand the second object of our work in this area—the relations and structure of the Coastal Cordillera—it is perhaps necessary to say something about the structure of the Andes. The traditional view of these mountains regarded them as a chain of fold mountains, similar in general character to the Alps, and formed, in the main, at the same date. This theory has been disproved by the work of several geologists, and the existing Andes have been shown to be, not a simple range of fold mountains with a north-south trend, but a raised plateau, now in the course of dissection. Mountains, upraised by earlier folding, accompanied by volcanic eruptions, have been planed down to a level surface, and the plateau so formed has been elevated, again to the accompaniment of volcanic activity. Minor folding has taken place subsequently, but the existing mountains, except when they are of volcanic origin, are due in the main to the excavation of deep canyons through the agency of rivers, and the older grain of the country is a very ancient structure, trending east-west rather than north-south.

To return to the Coastal Cordillera. As early as 1908 Professor Gregory had suggested that the westward projection of the coast of Peru, which was

originally regarded as due to a curve in the Andes, analogous to that of the Carpathians in Europe, might be due to the Andean folds being deflected by the interference of an older line of mountains. He referred to this earlier suggestion in his Presidential Address to the Geological Society in 1930, where he says, when speaking of the former extension of South America into the Pacific, "The sudden north-westward bend of the coast in Southern Peru is the most conspicuous feature in the western side of South America; and, as I pointed out in 1908, this trend is coincident with ancient structural lines, along which the Andes were deflected north-westwards during the Cretaceous folding. Where the coast resumes its normal trend to the north the mountain structure does not make the same change, but continues north-westwards, and is cut off by the Pacific."

Other writers, notably Professor C. I. Lissón and the late Professor G. Steinmann, advance the view of the Coastal Cordillera as the remains of an ancient mountain line. Professor Steinmann named it the "Chimu Andes" after the early tribe of that name, and represents it as passing out to sea from Pisco, and as having been continued north-west to the Galapagos. He suggests that the range divided, one branch curving back to join the mountains of Central America, a second passing through Clipperton Island and the Revilla-Gigedo group to the mainland of Southern California, and the others continuing to the Hawaii Islands, the Paumotu Archipelago, and the Marquesas.

The evidence as to the relation of the Coastal Cordillera to the main Andes depends largely on the nature of the rocks, and our specimens have not yet been worked out. In the field however they appeared to consist of ancient rocks, similar to the older rocks of the western Andes. The coastal mountains in our area, from Paracas Peninsula to San Juan Bay, did not show any traces of Alpine structure, suggesting an independent range of fold mountains, and Professor Gregory came to the conclusion that they represented a detached outlier of the main Andes, which had been cut off by faults.

The western front of the Andes in the region east of Nazca has been carved by parallel valleys into a number of long ridges, which project into the plain, so that the junction of the rocks of the foothills with the boulder-strewn plain is extremely sinuous. The ridges however terminate along a north-west to south-east line whose regularity, in conjunction with similar features seen at Ica, suggests that the western front of the Andes here follows the line of an ancient powerful fault.

(iv) *Ancient Irrigation System of Nazca*

Before setting out on the second stage of our journey we spent some time at the interesting little town of Nazca. The Nazca Valley was cultivated from very early times by an elaborate system of irrigation, and became the centre of one of the best known of the earlier cultures. Sir Clements Markham, in describing this system of irrigation, speaks of it as deriving its water by unknown subterranean channels from far-distant sources high up in the Andes. Professor Gregory however considered that the water collected could be accounted for, both as regards level and volume, as being of local origin, derived by seepage from the bed of the Nazca River. Series of successive floods have piled along this river a sheet of sands and gravels, which the floods charge with water.

Tunnels, driven under the bed of the river, collect water from the gravels and discharge it into irrigation ditches on the lower land beside the river.

B. Traverse of the Andes

Our way into the Andes from Nazca lay up the Blanco Valley. We did not regret the change of plan necessitated by the damage done by floods along our original route, as the more southerly course we pursued through the Province of Lucanas led us through country that was even less known geologically. The geography and geology of the Peruvian Andes are best known along the lines of the two trans-Andean railways, and in some associated mining fields. The northern line traverses large tracts of marine sedimentary rocks, and volcanic rocks are rare; the southern line crosses large areas of volcanic rocks, and the sediments differ in character from those to the north. Between the two is an area which is little known geologically except in a few mining centres. Our route led across one of the least-known parts of this intermediate belt.

We emerged from the Blanco Valley on to the wide plateau, described by Mr. Coverley-Price, which rose steadily inland over terrace after terrace of horizontal sheets of lava, mostly trachyte. Where older rocks appeared from beneath the sheets of volcanic rocks, they were similar to those of the Coastal Cordillera. As we progressed inland the dissected plateau nature of the country became more evident, the plateau being intersected by tremendous canyons, some of them 6000 feet deep. We crossed the watershed between the Atlantic and Pacific at a height of about 16,100 feet, over a ridge which showed clear evidence of glaciation in its moraines and the ice-scratched surfaces of some of the rocks. The character of the divide was intricate and appeared to bear no relation to the main trend of the Andes. On the far side we descended through an interminable *puna* valley.

C. Eastern Front of the Andes

On the Atlantic side of the divide we met our first sedimentary rocks. These consisted, over large areas, of red sandstone and clays, like the New Red Sandstone of the English Midlands, and like it deposited on land, or in shallow lagoons or lakes. The only marine deposits encountered were of shallow water type, and the area as a whole appeared to have been above sea-level for the greater part of geological time. The grain of the country appeared to run east-west, and not north-south, and Professor Gregory regarded this area as an ancient, persistent highland, separating the different areas to north and south.

Our way down the eastern front of the Andes lay along the valley of the Vilcañota River, till it joins with the Yanatili to become the Urubamba. In this region our interest centred principally in the river system, which forms an intricate network of deep valleys, made by river erosion along lines guided by the structure of the rocks and the mountain movements of the area. The successive stages by which these valleys have been deepened are clearly seen in the section between Cuzco and Rosalina, the oldest rivers of which there are traces being represented by high-level terraces; relics of old valley floors. The note-books containing our records for this part of the journey have unfortunately been lost, but from some notes made by Professor Gregory at Rosalina, which have been preserved, I gather that he inclined to the opinion that the rivers began at the time of the uplift of the east-west range of mountains,

marked by lines of snow-capped peaks, to which, I believe, the Spaniards first applied the name of "Andes," afterwards extended to the whole mountain system of western South America. On the upheaval of this east-west chain of mountains the drainage would at first have been, on the north side, from south to north. The original northward streams have been broken up by the excavation of a series of east-west rivers, due perhaps to folds, or to erosion along weaker bands of rock on east-west lines. These rivers were the first series of subsequent streams, and contribute the most conspicuous parts of the present rivers. Some of them may formerly have been connected, but they have been broken up by the development of a second series of subsequent rivers, which flow north-south, and are the most active and growing rivers of the area. Some of them follow the lines of the north-south fractures and compression joints due to later Andean folding.

Mr. Coverley-Price has described to you our wait at Rosalina, and the decay of that once flourishing settlement. The inland trail of which he speaks was surveyed by a Peruvian engineer, Luis Robledo, in 1902–04, at which time Rosalina was a place of considerable local importance. We had seriously considered the possibility of making use of this route, but Mr. Tarnawiecki wrote us from Maranquiato, "The trail is in terrible shape; at several landslides (and there were plenty) I had to take off my shoes to keep a hold on the ground, and even the Indians had difficulties. It is out of the question to pass our cargo over this trail, and even without it is positively dangerous." We therefore decided to trust to the canoes.

Above Rosalina the river is not navigable for canoes at any season of the year. Below are a succession of rapids, which are only navigable by canoe during certain months, after the floods of the rainy season have subsided. As conditions vary from year to year it is difficult to give a definite date at which canoe navigation becomes possible. The river should however in normal years be navigable from April onwards. The rapids are largely due to accumulations of fallen material, and therefore tend to vary also from year to year, which increases the difficulties of navigation even for the Indians who know the river intimately.

At the Pongo de Mainique the river narrows to cut its way through a last barrier of hills, emerging therefrom into the wide Amazonian plains. Below this point the rapids are fewer, and not of a serious nature. Owing to the narrowing of the river bed at the Pongo de Mainique, the velocity of the current is increased, and a rotary movement of the water is set up round some of the bends, which, together with shifting whirlpools, makes this part of the river one of the most difficult to navigate. This year there had been heavy landslides just above the entrance to the Pongo, which may have led to a further narrowing of the mouth of the gorge. One of the photographs here reproduced shows the gorge at the Port of Megantone, the point which may be reached by clambering along the rocks on the right bank of the river. Later, as I think is shown by the second photograph, this becomes impossible owing to the perpendicular and water-worn nature of the cliffs. The apparent stillness of the water in the second photograph, in contrast with the turbulence of the first, is due to the rotary motion of which I have spoken, the water in midstream being as violent here as at the Port of Megantone. The cascades in this picture are a little

below the Port of Megantone, and it was not far from here that the accident occurred in which Professor Gregory lost his life.

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(3) C. I. Lissón, "Como se generó el Suelo peruano," *Bol. Soc. Geol. del Perú*, T. I, 1925.
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(5) C. Markham, 'Cuzco; a Journey to the Ancient Capital of Peru,' 1856, pp. 46–48.
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DISCUSSION

Before the papers the PRESIDENT (Admiral Sir WILLIAM GOODENOUGH) said: We had hoped to have welcomed here to-night the Brazilian Chargé d'affaires and his colleagues from the Embassy, but the lamentable occurrence which has deprived Peru of its President has, very naturally, prevented them coming here to-night. We extend to them our sympathy in their loss. Any reference in this hall to Peru must bring to the minds, especially of the older Fellows, the memory of Sir Clements Markham, whose bust, placed in our forecourt by the Peruvian Government, is a constant reminder of his work as the historian of that country.

The country of which we are to hear to-night, in lat. 12° to 14° S. and in long. 70° to 72° W., has been very little visited, though Cuzco and its environs are well known. Dr. Isaiah Bowman visited it in 1911, and a good account of that particular area will be found in an early chapter of that very informative book he wrote, 'In Sight of the Andes of South Peru.' He speaks of the visit of an American, Major Corby, the name of whose book I cannot trace but of whose journey some account will be found in the Society's *Journal* of 1898 and also in the *Journal* of the Peruvian Geographical Society of Lima for the year 1904. Any remarks which I have to make about the country itself I will defer until later in the evening, if time permits.

Professor Gregory had long wished to visit Peru in order to complete certain geological investigations he had already begun and made both in Africa and in Australia. He lost his life on the journey, and it is left to Mr. Coverley-Price and Miss McKinnon Wood, his two companions, to tell us of his expedition. Mr. Coverley-Price, who will speak first, was at Harrow and at Cambridge, and is a member of the Diplomatic Service. Some years ago he wrote to the Society and asked what were the chances of his undertaking a journey where his knowledge of the Spanish language could be made use of, and he went with Professor Gregory on his journey to Peru. Mr. Coverley-Price has illustrated that journey with his brush, having produced some charming water-colours about 150 of which will later be shown in the exhibition room of this Society.

Miss McKinnon Wood will speak after Mr. Coverley-Price on the geological aspect of the expedition. She was at Girton and had for many years been a scientific friend of Professor Gregory's. She being an ardent collector of fossils, he relied upon her for the stratigraphical side of the expedition.

Mr. Coverley-Price and Miss McKinnon Wood then read the papers printed above, and, during the discussion, tributes were paid to the memory of Professor Gregory.

Lord CONWAY: My qualification, if I may so call it, for addressing you this

evening is not any expedition that I may have undertaken into the heart of South America. I stand here simply because I wish to speak of Professor Gregory.

Professor Gregory accompanied me in 1896 on my first expedition to Spitsbergen, and I had the great privilege and pleasure of being with him for several months and seeing him attack the geological problems that he had to discover and solve there. It was remarkable to note the rapidity and vividness with which he grasped a whole country, saw its geographical and geological relations almost at a moment's notice. His mind was stored with the remembrance of any similar phenomena that he might have observed elsewhere. He made one country or one district illuminate another. He was full of originality and his interests were not merely confined to geology: they embraced all things human. He was full of understanding of every kind of thing. In spite of a certain nervousness and jerkiness of manner he was, in fact, a man of humour; he regarded everything with a lightness and courage that faced any kind of difficulty that lay before him with a gaiety of heart and brilliance of appreciation which made it a pleasure to be with him. I make no doubt he would have added another important chapter to the long series that he wrote, or might have written, about his researches and discoveries in different parts of the world.

I had some talk with Professor Gregory about the part of South America covered by his journey, but I could not tell him anything that would have been of use to him because, in fact, the part of South America he was going to traverse was quite unknown to me. I crossed the Andes twice, once by railroad and once in the neighbourhood of Mount Illampu, which is a rougher kind of journey. I brought home a series of mineralogical specimens which were analysed by Professor Bonney, and I think he wrote a paper upon them.

To me the striking feature of that part of South America that I traversed was the two parallel Cordilleras, the coast range and the inner range, the Cordillera Reale; these two parallel ranges supporting between them a high plateau 12,000 or 14,000 feet high, on which is Lake Titicaca, which is seven times as large as the Lake of Geneva—that high plateau with the coastal range of volcanic mountains, and the interior range on which we saw no evidence of volcanic action; those two great ranges facing one another are the most striking feature of the structure of South America south of Lima and south of Cuzco. My business was to climb on the two great ranges in the interior, and as I travelled I saw always in the western districts that obviously volcanic range. I pursued it southward. The violence of volcanic action which that range is witness to, the extraordinary and incredible weirdness of the landscape it has formed, are so remarkable that I would have given much to have been able to visit the region with Professor Gregory.

Well, he was destined not to return from Peru. His life was a life of great activity. He has left behind him admirable work. He perished, I may say, while writing his last chapter. We shall remember him always with veneration and with affection, and I am glad to have been able to make these few remarks about him.

Mr. J. M. WORDIE: I hope you will allow me, as you have allowed Lord Conway, to speak about Professor Gregory as a traveller and geographer rather than in reference to Mr. Coverley-Price's paper. Many geologists can be accused of not being able to see the wood for the trees, but Professor Gregory was very different and each piece of work and research which he undertook seemed to fit into a picture of the world in general which he was forming. His main interests in tectonics and in palaeography, and his great journeys, were all part of a plan which he had of visiting critical sections which bore on certain Earth theories which he held. At the same time, his tectonic interests, dating

from the time of his discovery and naming of the Rift Valley in Africa, did not prevent him from working and writing on almost every other branch of geology. He wrote on fjords, which he studied in Scotland and elsewhere; he wrote on fossils; he was intensely interested in glaciers and glacial work; and his geographical interests led him even to study problems of race and population. Practically everything he said and wrote was of interest to other geologists, and also to a much wider public, so that he soon became the most popular writer on his subject in our times. I can speak thus of him because I was one of his earliest pupils, and ever since receiving instruction in geology and geography from him, I have maintained and valued his friendship. When he first came to Glasgow as Professor of Geology, he came with a great exploring reputation, having travelled in East Africa, in the heart of Australia, and with Lord Conway in Spitsbergen; and it was only natural that his teaching should be of an inspiring nature. In Scotland, lecturing in the Universities is mainly done in the winter, and Professor Gregory used to take his pupils out on to the hills in the depth of winter in rain and snow, endeavouring perhaps to recapture, as far as he could, the Arctic conditions of Spitsbergen. He inspired many of us then, and his pupils to-day are scattered all over the world. I should like to speak for them, and perhaps also for the many others who have not been taught by him but have found themselves at some time or other in regions where Professor Gregory has been before them; I think we would all desire to join to-night in paying a tribute to such a great geographer and teacher.

The PRESIDENT: May I first express to you both, Mr. Coverley-Price and Miss McKinnon Wood, how deeply we sympathize with you in what was a most trying experience and congratulate you on having come through it not only with your lives, but with great credit to yourselves.

After what has been said by Lord Conway and Mr. Wordie I hesitate whether to add what I wrote of Professor Gregory this afternoon. I did not know him as well as either Lord Conway or Mr. Wordie, but my friendship with him showed me how he combined the study of geography in all its branches in a very real way. The love of his fellow-creatures gave him an outlook on everything that was comprehensive of the archaeological part and of that economic part that Miss McKinnon Wood spoke of. I know I am only echoing what every one in this Society would think when I repeat what I said last year, just after his death, that we have a most deep sense of loss.

I turn to that very interesting chapter in Dr. Bowman's book on the region under discussion; and may I say to those who happen to be unacquainted with the terms used that a *pongo* is a narrow passage, and that the Pongo de Mainique means, more or less, the Narrow Passage of Parrots. Very few people seem to have undertaken the journey. Not more than a dozen went down between the years 1907 and 1911, and of those most lost either the whole or some part of their cargo.

Dr. Bowman experienced the same difficulty in making himself understood that many others have, and it is interesting to note here how very clearly those who have no power of conversing by word of mouth with each other can make themselves understood by signs. I dare say many present remember the very interesting lecture given by Mr. Dyott. Dr. Bowman, in his book, gives a very interesting account of a most dramatic description given by signs by a native of his trip down the river. He experienced, as did Professor Gregory's expedition, difficulty in obtaining men to man the canoes. I came upon a sentence in which he said: "Once in the swift current the canoe becomes helpless as a chip of wood," and he speaks of the skill of the Indian in handling his craft, and then follows a very interesting chapter.

There does not seem to have been much change in that country, but, no doubt, in time there will be developments. When those developments take place and the country, perhaps, in years to come is fairly well populated and, we hope, prosperous, credit will be given to those who, like Professor Gregory and his companions, have obtained and imparted to us information with regard to that part of the world.

May I again refer to the very charming water-colours done by Mr. Coverley-Price? We wish very much that they could have been reproduced in colour on the screen to-night. Finally, I would ask you, Mr. Coverley-Price and Miss McKinnon Wood, to accept the best thanks of the Society and of this audience, both for your work and for the very interesting description which you have given of it.

THE USE OF THE NEW GRID ON ORDNANCE SURVEY MAPS: *A discussion at the Afternoon Meeting of the Society on 10 April 1933, opened by*

BRIGADIER H. StJ. L. WINTERBOTHAM

IN March of 1924 three of us met in prophetic vein to give you our views as to the choice of a grid for our national small-scale maps. The three statements are interesting and the discussion is one which well repays reading. We started with one or two premises. The grid was to be suitable for all national purposes, scientific and social, civil and military. It was to be kept properly in its place, and not to interfere with the convenience of the public or with the high standard of our national cartography. Lastly, it was to be founded on national units of length.

We are met again to discuss how this grid should be used by the man in the street, for it is now an accomplished fact, and appears on many of our small-scale maps. It is superimposed as revisions are completed, and in ten to twelve years' time it will be on every small-scale map of the Ordnance Survey.

A discussion on how to use the grid is not interesting to any soldier still upon the active list. He had, for long, used it in all geographical emergencies of life. It may help to discuss for a moment why he does so. We will suppose war, and we will take the case of a staff officer of a division which is just relieving another and taking over a section of the front at present unfamiliar. That staff officer will be the first man of his formation to reach the new headquarters, and he will be given tables of everything that affects that part of the front, from a list of the position of every unit down to one describing the licensed houses which are out of bounds. In each and every case the list is complete with full co-ordinate reference to the spot concerned. There is no room for misunderstanding.

Leaving divisional headquarters he settles into his car and proceeds to a brigade headquarters near the front. While he is lighting his pipe he wakes up to the fact that he has already lost his bearings in a strange country; stops at a signpost, and finds painted upon it the co-ordinates of that spot. He finds to his horror that he has left his 1-inch map behind, but he has a $\frac{1}{4}$-inch, and the reference applies to it as well. Directing his chauffeur to follow a certain road, take the third turning to the right and then in 300 yards a track over the fields to the left, he finds the headquarters from its co-ordinates, without trouble. On leaving he goes farther forward by a sunken lane, where he gets hopelessly stuck. He sends his chauffeur back to telephone from brigade headquarters to division headquarters the co-ordinates of the point where his car is to be found and salved, and orders another car to be at certain co-ordinates at a certain time. Completing his inspection on foot, he finds the car where he has appointed, and returns to headquarters. We will follow him no longer, and take the analogies into civil life.

The tabular information concerning distributions is growing to considerable national significance. Let me take as a first instance the work of that exceedingly efficient body, the Committee on English Place Names. Names are listed and referred to in terms of the lettered and numbered squares of the

1-inch popular series. As a corollary these lists cannot be followed on the 1-inch district map of the neighbourhood (if one exists), nor upon $\frac{1}{2}$-inch, $\frac{1}{4}$-inch, or 10-mile, nor upon any map, in fact, which is bounded by different sheet-lines. Such a reference does its work in a poor sort of way, for it postulates a definite map, and it implies a search over a space of 4 square inches of crowded detail for the name in question. There are those who ask why they cannot be left in peace with the sheet-lines they were accustomed to. One has something of the same feeling in a church of advanced tendencies. The answer is that the critics themselves in their turn called for sheet-lines much more convenient than those of the early copper-printed 1-inch, and are now attempting to fasten their choice upon posterity. Sheet-lines are matters of convenience and fashion, and not ends in themselves.

New and better lists and gazetteers are beginning to appear on the new national grid in spite of its youth. The first one concerned the licensed premises under the jurisdiction of certain county authorities, whilst the latest is a Plant Survey of Studland, near Poole. There are so many uses for gazetteers and for tables of reference that it is a mere waste of time to speak further of them.

Now we will turn to the case of the signpost. Quite obviously those very efficient bodies, the R.A.C. and the A.A., will presently amplify their traffic signs and signposts by giving the position of the points at which they are erected. We are all agreed, probably, that a map is an indispensable companion to a wander through the countryside in order that we may direct our steps to the quiet and unspoilt, whilst at the same time becoming aware of local archaeological or historical interest. It is however easy, in moments of thought, to lose one's position on the map, and it will be remembered that the stranger from whom one asks the way generally replies, "I am sorry, sir, but I am a stranger here myself." The position of every signpost should be given on it.

Now let us turn to the accidents of life. Unfortunately they will occur. The broken-down car is, of course, a common one, but there may be many others, such, for example, as the depredations of a musk rat on the banks of a stream. These accidents demand attention and repair, and the first item of necessary information is where to get to, in order to effect that repair.

Now for the meeting-place with the second car. We are always meeting people, and we are always making arrangements which connect with this or that locality. Let me instance the fact that it is often valuable to know at what spot the motor bus of, shall we say, the Heliotrope Line, will stop on such-and-such a road. To the stranger within the gates it is not very helpful to be directed to the "Rose and Crown" or to the corner 100 yards or so beyond Mrs. Atkins's shop. All meeting-places can, and no doubt will, be described in terms of the grid so simply that no misconception is possible. Here is an every-day convenience.

Finally, let me refer to the co-ordinate address of that brigade headquarters. The other day my wife and I decided on a summer trip to a certain locality, and wrote for particulars, having a list of addresses of likely farms from local authorities. It was impossible however from the addresses to identify the positions of these farms on the 1-inch map, for no map is completely up to date, and many of the farm names do not appear on the existing sheet. It may seem to some of you ridiculous to foreshadow the day when a co-ordinate reference

will be on notepaper and visiting-card. Yet I have no doubt at all that it will come.

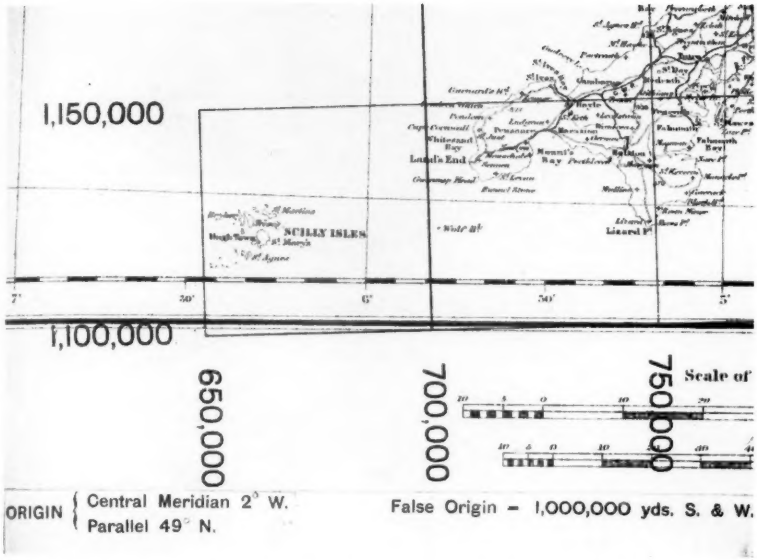
I would like to say here that one critic whose forthright sayings, like the little girl with a curl on her forehead, are either very good or very bad, calls us to order for militarizing the nation with this grid. I am not quite sure what he means. In a sense all charts and such small-scale maps as the 1-inch and $\frac{1}{4}$-inch are a gift to the civilian from the sailor and the soldier, but in no other sense can the grid be called military. For many years map-makers have been anxious to evolve and to use a good system of map reference. The national grid as now in use is the highest form of reference so far evolved.

We must now consider how the grid is being shown upon the maps on which it appears. Obviously, for those who have with them scales and can make allowance for paper distortions, it would be sufficient to show the co-ordinates of the corners of the map. Such a system would certainly lack a good deal of convenience. The system of reference should be such that it can be used by eye, or in the worst possible case with the use of a small reference card; shall we say some 2 inches square. Eye measurement cannot be carried too far however, and lines of definite and progressive co-ordinate value must be shown over the face of the map if it is to be possible.

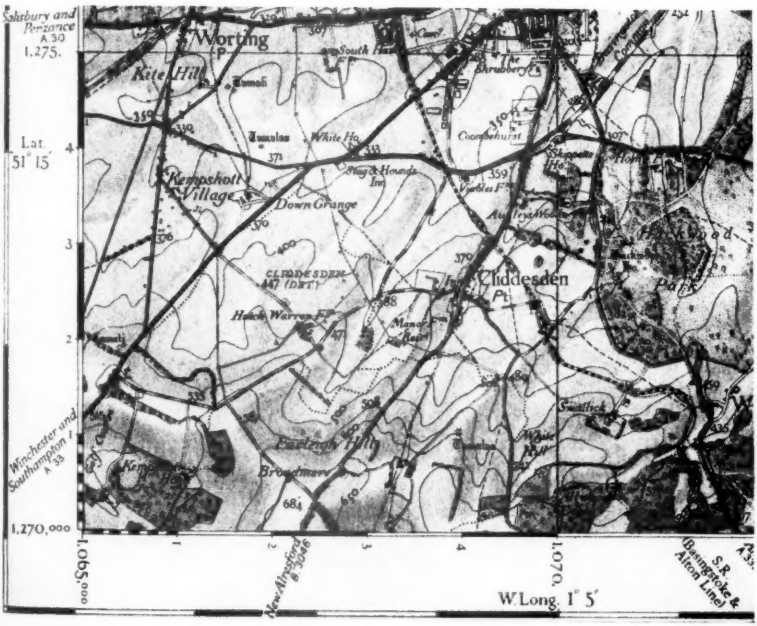
All national grids—and they are practically universal now—are decimal in this sense, that they rely on thousands, hundreds, and tens of units, and the co-ordinate lines which are shown are in multiples of thousands, hundreds, or tens, according to scale. As Brigadier Jack pointed out in 1924, the most convenient lines to use for reference purposes may not be the lines ultimately shown, for they may be so many as to interfere with the pleasant appearance, or, more important still, the legibility, of the map in question. A grid in yards —and that is the unit which we use—is rather awkward to manage on the 1-inch. A distance of 10,000 yards between co-ordinate lines is over long for practical convenience. A 1000-yard distance would imply too many lines over the map. We have therefore compromised on a distance of 5000 yards. But if the 5000-yard distance is convenient on the 1-inch, obviously 10,000 yards are equally convenient on the $\frac{1}{2}$-inch; and if not convenient, at any rate not too bad upon the $\frac{1}{4}$-inch. Having once printed these lines at right angles to each other over the face of the map we can now find the co-ordinates of any desired spot quickly and accurately.

But here we come to another matter of practical convenience. A country doctor, for example, whose professional activities are confined within a radius of 10 miles from his front door, will naturally not desire to use every time a number of figures sufficient to cover, within their range, the whole of Great Britain. That is the first time we strike a doubtful point. Some practical technique of figure referencing will no doubt be invented. The question is, what?

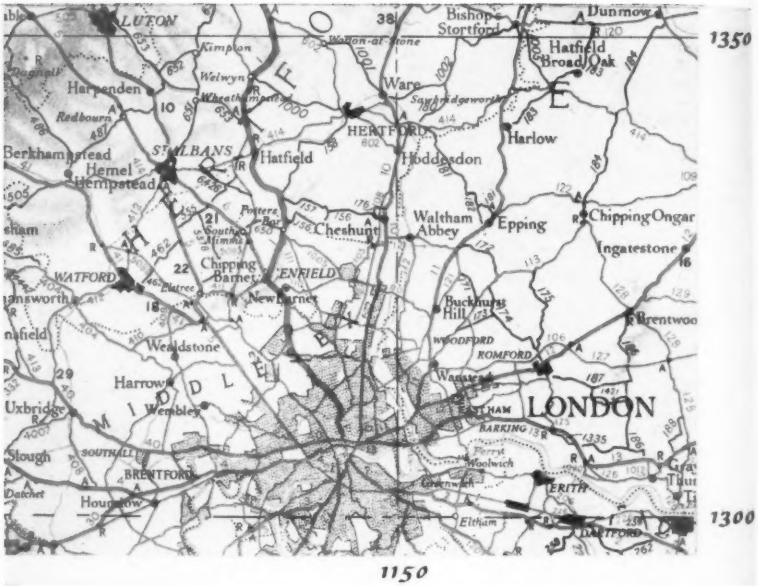
It is immaterial for the present to discuss the type of projection whose co-ordinates we use for the national grid, and it is equally immaterial to discuss the latitude and longitude of the origin, or the position of that point whose numbers run consecutively. It is enough to think of this origin of numbers as lying remote to our south-west coast in order that we may work eastwards and northwards in constantly increasing numbers, but always keeping to the same sign. For practical convenience it is obvious that we cannot contemplate



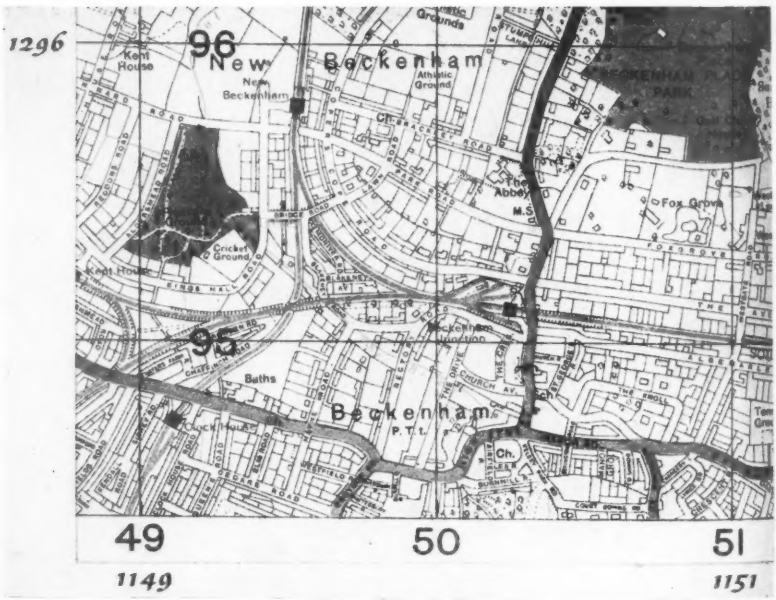
The National Grid overprinted on a portion (slightly reduced) of the 1/M outline of Great Britain



S.W. corner of a new 1 inch to the mile sheet. Grid squares 5000 yards; grid lines figured in kiloyards with full figures of yards at corner



Piece of the Ministry of Transport 10 miles to the inch map of Great Britain. Grid squares 50,000 yards; grid lines numbered on figure in kiloyards



A piece of the 3 inches to the mile map of London. Grid numbered in kiloyards, omitting first two figures; the full grid number added in the margin

a mixture of minuses and pluses. A point which we might have thought of in fixing the position of the origin of numbers was to secure some round number for a central point in London. That central point might have been Big Ben or the Dome of St. Paul's or the front door of this Society, according to balance of opinion. Unfortunately we made no such provision, and as the co-ordinates run in London there is nothing of importance which coincides with an easily remembered number.

Co-ordinate lines will be understood best by reference to the corners of sheets of the different series. There is shortly to appear a 3-inch-to-1-mile map of London which is designed to facilitate the work of visitors as well as of residents. It will be accompanied by a full gazetteer, and its marginal grid directions consist of two figures, the last of which indicates the number of thousands of yards. The two figures are necessary for this small area because the area concerned is more than 10,000 yards and less than 100,000 yards in either sense. For local use in Greater London we can consider the origin of numbers to lie close at hand. For the moment we are concerned neither with John o' Groats nor with Lands End, but the system is really the same and the full co-ordinates can be given if required. Ultimately then the use of the grid will sometimes be local, sometimes (for Great Britain) universal.

With regard to the 1-inch, I have already called your attention to the fact that the distance between co-ordinate lines must for convenience be 5000 yards and not 10,000 yards, as the decimal system would seem to suggest. It has been suggested that the intermediate fives should be left in the form of thin lines, but should not be numbered in the margin. The consequence of this step would be to work in a square of 10,000 yards, or about $6\frac{3}{4}$ inches on paper. This is too large for practical convenience in my opinion, and I prefer to retain the fives. I shall show you presently a type of "Romer" which goes very well with this division and makes sub-division simple and quick.

It has been suggested that we should employ the word "kilo-yard" to express a unit of 1000 yards, and that additional figures should be given after the decimal point (if required). The idea is a good one. Its adoption would diminish the risk of losing grip on distance among so many figures. I would however like to draw your attention to the fact that the last three figures which would be after the decimal point if we adopted a kilo-yard system are always shown by us about half the size of previous figures. In effect, we have by symbol adopted a kilo-yard unit.

Passing to the $\frac{1}{2}$-inch we come to a 10,000-yard square and return to more normal decimal practice. One further remark I would make about this $\frac{1}{2}$-inch. We have at present a staff too small to make it possible to redraw and reletter our $\frac{1}{2}$-inch series. I am sorry that such is the case, for this old $\frac{1}{2}$-inch, useful map as it is, is not modern in the legibility of its names and tends to be overcrowded. As a consequence when in Scotland we make up a special $\frac{1}{2}$-inch district map such as that rather beautiful production the Island of Skye, we are using material which was drawn on Bonne's Projection from a central meridian which makes an angle of nearly 2° with that of the grid lines of the new national system. Now 2° is enough to upset the look of the principal names. To have a name which, by hypothesis, should be written along a horizontal line running at a visible angle to the grid would be so unpleasant as to be impossible. On the

$\frac{1}{2}$-inch of Skye therefore and on any adaptation of the old $\frac{1}{2}$-inch of Scotland, the new national grid is not shown.

The $\frac{1}{4}$-inch margins are being rapidly adapted to the grid principle. There is little fresh to say about this scale, but it will be seen that the grid numbering is plain, and that the grid scales suggested in the first instance by Mr. Hinks are given here, as elsewhere.

In the case of the 10-mile map the grid is not given so much prominence. I am not sure whether we were wise or not in our thoughts. It must be remembered however that the smaller the scale of the map, the more do we turn to a latitude and longitude division, and the less do we think precisely of the position of any one spot.

If any one thinks that we are being singular in the introduction of a grid

SHEET GAZETTEER
OF THE
ONE-INCH 5th RELIEF EDITION
Sheet No. 144 (Plymouth).

Kilminorth	,,	...	806,800	1,168,400
KILN WOOD	,,	...	806,400	1,169,600
King Doniert's Stone	,,	...	807,100	1,184,700
Kingsand	,,	...	828,800	1,164,700
Kingseat	Devonshire	...	844,300	1,185,800
KINGSMILL LAKE ...	Cornwall	...	827,800	1,176,000
King's Tamerton ...	Devonshire	...	830,800	1,173,600
Kingston	,,	...	851,000	1,161,700
King Tor Halt	,,	...	843,100	1,189,400
KIT HILL	Cornwall	...	822,300	1,187,400
Kitley	Devonshire	...	842,500	1,165,700
Knighton	,,	...	839,300	1,163,700
Knowle	Cornwall	...	810,800	1,188,800
Ladye Park	,,	...	807,400	1,180,200
Laira	Devonshire	...	836,400	1,170,600
Laira Bridge	,,	...	836,100	1,168,700
Lake	,,	...	839,300	1,184,000
Lambest	Cornwall	...	815,000	1,178,800

Full grid references in yards

system let me amend his judgment. We are one of the last in Europe to come to it. I will show you the way in which national grids are shown and numbered in the margins of some foreign maps, but I would go on to say that this illustration, taken from the 1929 text-book of Map and Photo Reading, may already be out of date. I have not followed developments in foreign maps as closely as I should have done. I think it will be agreed that we are taking more trouble in England to make the purpose and the use of the grid plain than these foreign maps are doing.

You will remember that in practice the grid will be used for eye measurement in the majority of cases, and exact measurement only where precision is particularly desirable, as for example in the compilation of gazetteers. Where this precise measurement is required it can be obtained rapidly and easily by the use of a small rectangular scale. The pattern used by the French in the War consisted of a small rectangular bit of zinc in which the two arms were so

graduated that one edge was read along the grid line from the corner, while the other, at right angles, read upwards to the point in question. The one we ourselves used was exactly the same in principle, but differed in this minor particular that a corner of it was put actually on the point whose position was to be determined, while the scales at right angles to each other and along the edges of the little card were placed by eye parallel to grid lines and read against them. Its use is extraordinarily simple when shown pictorially, but difficult to understand perhaps when described in words.

As a corollary to this Romer, as it was called after the gentleman who invented it, it is easy to make one for use with the grid in which the interval is 5 instead of 10. In such a case the marginal scales are duplicated, one reading from 0 to 5, and the other, below and parallel to it, from 5 to 10. Here again it is easy to explain the thing by illustration but difficult to do so in words.

Last of all, I should like to refer to the gazetteers which are in the making. The London 3-inch-to-1-mile will have its gazetteer so that the position of any street can be found at once from the co-ordinates of the centre of the written name of that street. This map is constructed on exactly the same principles as the War Office edition of 1926. It is a most amazingly useful production, and for years past I have relied on it for the identification of any place in London which I may happen to have to visit, from that of a dressmaker to that of a Department of State.

The gazetteers of the individual 1-inch sheets are compiled during the drawing of those same sheets. When they are complete for Great Britain they will provide the material for a general gazetteer which will show not only the position of every place, but the actual type in which the name is written.

GAZETTEER
TO ACCOMPANY THE
3-INCH MAP
OF
LONDON

Abbeville Rd.	415	002
Abbeyfield Rd.	477	049
Abbey Gars.	380	037
Abbey Gro.	607	050
Abbeyhill	608	985
Abbey La., Kilburn	372	103
Abbey La., West Ham ...	517	099
Abbey Rd., East Ham ...	574	103
Abbey Rd., Newbury Park ...	582	157
Abbey Rd., Notting Hill ...	354	069
Abbey Rd., Park Royal ...	310	096
Abbey Rd., St John's Wood ...	377	103
Abbey Rd., South Wimbledon ...	380	954
Abbey Rd., West Ham ...	520	098
	522	101
Abbey St., Bermondsey ...	461	055
Abbey St., Bethnal Green Rd. ...	468	090
Abbey St., Plaistow, E. ...	535	088
Abbey St., Woolwich ...	588	047
Abbey Wood	608	046
Abbey Wood Rd.	606	049
Abbotsbury Rd.	363	057

Abbreviated grid references in hundreds of yards. The references in kiloyards would be: Abbeville Road 41·5 00·2

And now, Ladies and Gentlemen, I have done my part in explaining to you what is being done, leaving the gentlemen who follow me to point out how to improve upon it.

DISCUSSION

Before the paper the PRESIDENT (Admiral Sir WILLIAM GOODENOUGH) said: The paper that was to have been read this afternoon on "The extinct watercourses of the Fens" has had to be postponed on account of the illness of Major Fowler, and Brigadier Winterbotham has come at short notice to read a paper on "The use of the new grid on Ordnance Survey maps." Some of us may be asking what a grid is, others will ask what it is good for, and all will ask whether it is the best method for producing what it professes to produce. Concerning this Brigadier Winterbotham will tell us, and I will now ask him to read his paper.

Brigadier Winterbotham then read the paper printed above, and the discussion continued as follows:

The PRESIDENT: We had hoped to have Sir CHARLES CLOSE with us this afternoon, but he has been unable to come and has sent a short note as follows: "The establishment of a uniform projection for the small-scale maps of Great Britain, the choice of the Transverse Mercator for this projection, and the selection of the origin of co-ordinates well to the south-west, so that co-ordinates shall all have the same sign, are all steps in the direction of progress, and I, for one, warmly welcome them. And I think that we shall, most of us, approve of the grid lines being drawn at intervals of 5000 yards, an interval which, on the 1-inch scale, gives a network of squares of a little less than 3-inch side. Another good feature is that the size of the 1-inch sheets includes a definite number of the grid squares, so that we no longer have the rather awkward arrangement of sheets 27 inches long, provided with a 2-inch grid. All the above alterations are, I think, improvements. But there is one difficulty with the new system, and this deserves consideration, though it is not insuperable.

"The difficulty is that of indexing. Let me give two examples. In the Quarter-Inch Atlas of England and Wales, one of the most useful features is the Index. This is exceedingly simple, for each folio of the Atlas is covered with 2-inch squares, with letters down the sides of the folio and numbers along the top and bottom. A reference is very straightforward: thus, Salthouse, Folio 12, F 10.

"Another example of the use of the present system of indexing is to be found in the employment of the 1-inch sheets of the Popular Edition by the English Place-Name Society. In the volumes published by this Society every place-name is referred to the appropriate sheet of this edition of the 1-inch map, and the grid square in which it falls. Thus in the latest volume, No. X, published by that Society, 'The Place-Names of Northamptonshire,' there will be found hundreds of entries such as the following, Glendon, 74 E 1; which being interpreted means that that place-name will be found on 1-inch sheet 74, and in square E 1. Nothing could be simpler.

"But how are we going to index such names by the use of co-ordinates? Well, it can of course be done. We can use, say, four figures for each co-ordinate. Instead of the simplicity of the present system we shall have something like this: 7698. 8524, with the addition, I suppose, of the sheet number. We shall have eight figures to remember instead of one letter and one figure, and this will add greatly to the labour of looking out the place-name required. Now I am in no way objecting to the use of co-ordinates for what may be called official purposes, and I see a good many advantages in the unified system which will apply to the whole of Great Britain. But I think that the convenience of the general public and of such bodies as the English Place-Name Society should also receive consideration. And to meet this, to my mind, reasonable contention, I would venture to suggest that letters and numbers should be printed round the margins of each sheet as heretofore. This would not interfere with the use of co-ordinates for official purposes; but the provision of such letters and numbers would add greatly to the comfort of the non-technical public; and the addition of these letters and numbers would carry on the century-old tradition of the Ordnance Survey, which has always striven to produce maps which should be equally useful to the public and to the Army."

The PRESIDENT: Brigadier JACK also could not come this afternoon, but has sent a note which I will also read: "I have read Brigadier Winterbotham's paper on the new grid on O.S. maps with great interest, and am sorry that it is impossible for me to be in London to-morrow to take part in the discussion. I agree with Brigadier Winterbotham's objection to the critic who spoke of 'militarizing' the

nation with this grid. It is absurd to apply such a word to the case. Most maps have some method of locating points. The grid is merely an improvement on certain of these methods; it enables one to fix a point with more exactness, and with no loss of simplicity. The fact that it has been adopted for use by soldiers does not make it military.

"While welcoming the application of a scientific grid to our maps, and agreeing that it will be invaluable for defining positions simply and accurately for most purposes, I think it perhaps a mistake to push its use too far. Those who travel by road from Southampton to London, for example, think necessarily of the journey in terms of the road, in other words, in terms of one dimension; and I cannot think that any advantage will be gained by saying that the bus stops at 4863. 2389, or whatever the co-ordinates may be, as compared with saying that it stops at the Post Office, Hartley Wintney. On the other hand there are most obvious advantages in being able to describe a point, without fear of mistake or confusion, by two numbers, instead of by its position with relation to the 'second l in Pwlheli,' or as lying somewhere in square B.8. And it is for these advantages that we are grateful to the producers of the new grid."

Colonel MacLeod: Brigadier Winterbotham, I think, has made out a very good case for the introduction of the grid system as a method of defining position. But I think that, to complete the picture, it is necessary to remind you that the grid can be used for other purposes as well, not only by the soldier but by the civilian. The co-ordinate can be, and is, used for calculating bearings and distances, and I have little doubt that the grid system will ultimately be required or brought into use also in connection with the defining and calculating of areas for the compilation of such information as Brigadier Winterbotham alluded to in his remarks about the lesser-crested grebe.

In dealing with the question of a grid for "map-referencing," as the soldier calls it, the principal point to consider is to secure a grid square of suitable size. The military history of this question is interesting, I think, because in France, where the grid system was applied first, the maps in use were on a scale of 1 : 20,000, or about 3 inches to the mile. On that scale the 1000-yard square worked out very nearly at the 2-inch square which Brigadier Winterbotham has suggested as being about the right size.

When the Great War was over and the Army returned, "glad," as some people said, "to get back to real soldiering," it was decided that it would be necessary to retain a grid system, and it was decided to adopt that used by our Allies, a system based upon the kilometre, and not the 1000-yard square. British maps in the war had the 1000-yard square on them, but the French used the kilometre square, and this had led to inconvenience when British and French troops were interchanged in different parts of the line. It was decided therefore to adopt the kilometre square, and the attempt was made to apply the kilometric grid on the ½-inch map, which before the war had been used for training in England. The result was that the grid square was so small that the map was practically buried in squares, and something had to be done about it. Curiously enough the Army, instead of scrapping this new-fangled foreign grid, decided to scrap its training map. It decided to scrap the ½-inch map and to adopt the 1-inch. That decision is rather interesting, because the scale of map used by the soldier is not a matter of indifference. Some scales are definitely better than others. Moreover, the soldier cannot now get along with only one scale to the map, he requires two, and probably three, and, as Brigadier Winterbotham has explained, directly you are unable to limit your operations to one scale of map, the difficulty arises that the grid square may be, and probably will be, of a different size on different maps.

It happens that the soldier does not require many scales, and very often he has

a choice of scales; he can use what scales suit him best, and if he can choose, say, a scale of 1/25,000 for one map and one of 1/250,000 for another, scales which are exact multiples of one another, he can by this sort of device keep his grid squares to the same size on all maps. It is the intention of the Army in future to try as far as possible to put that principle into operation.

The civilian of course cannot do this. The civilian map user has a great variety of scales offered for his use, on which it is impossible to maintain a uniform size of grid square. Brigadier Winterbotham has shown various devices by which a co-ordinate can be measured when the grid square is of something other than tens of units. That gets over the difficulty to a certain extent, but not completely, because, as he himself mentioned, there are many occasions where it is desirable to be able to divide the square into tenths by the eye, and if one divides a square of 5000 yards into tenths by the eye, one will get a different figure from that which is given by the Romers of which he spoke. There is an obvious source of confusion in this respect which I think Brigadier Winterbotham has under-estimated.

I will not elaborate this point however because I want to get to another point, namely, the selection of the grid unit. Brigadier Winterbotham opened his lecture by describing the yard as a perfectly good unit. I agree that the yard is a perfectly good unit, but at the same time I am not at all certain that it is the best unit for the purposes of a grid. Admittedly it is the military unit, but, as Brigadier Winterbotham has explained, he is not anxious that this grid should receive the brand of "militarism." It is perhaps academic of me to discuss the grid unit at this stage, because the yard has been adopted, and a change would undoubtedly, even now, be difficult. At the same time, the decision as to what unit should be adopted has very far-reaching results indeed, and before the yard grid has been woven into the administrative and economic fabric of the country, I myself think that the merits of the metre deserve more consideration than perhaps they have yet had. I might add that for every purpose specified by Brigadier Winterbotham the metre would do just as well as the yard.

I know that this question of introducing the metre into this country is one on which opinions differ very strongly, and I took the precaution, before coming to this meeting, of turning up the proceedings of the Conjoint Board of Scientific Societies, which went into this question a good many years ago. The result of their deliberations was rather interesting. The Board, you may remember, was definitely against any sort of compulsion. It was against the compulsory introduction of the metric system into this country, but it did say this, that it "freely admitted that on the whole it would have been an advantage if we had adopted the metric system a hundred years ago before industry and commerce had reached their present complexity." The Board however was not convinced that compulsion was required to secure the principal advantage of such a change. The change, it said, might perhaps be more readily secured by an enlightened extension of the practice already existing.

Now, if that committee was right in saying that the metric system could "with advantage" have been introduced into this country a hundred years ago, I feel certain that the advantages must be very much greater now. The world has been knit together since then far more closely than was the case when the metric system was introduced. The metric system has won its way into the economic fabric of the world very much on its merits, and in the use of statistics and so forth it has made it possible to undertake compilation in a form which is of world-wide and not only local application.

I cannot help thinking that if the committee were writing that report now they would say that the advantages—which unfortunately they did not specify—had greatly increased. I entirely agree that the difficulties of the introduction of the

metric system have also increased, and it is a matter of opinion which of those two has increased in the greater ratio. But if one concedes the desirability of introducing the metric system into this country, I suggest that the introduction of this grid system into British cartographic practice presents as good an opportunity of doing so as is ever likely to occur.

Capt. G. T. McCaw: I should like to speak of one aspect of this question which I think is worth mentioning, and that is the fact that this grid system under discussion this evening is by no means new. It has been going on for very many years. I think that sailors were the first to introduce it. We are all very well acquainted with the maps of the world that we see in atlases—maps which are covered with peculiar curved lines. Those curved lines are very interesting, but extremely difficult to use in practice; the sailor, navigating the oceans, very quickly found that he was unable to take his bearings with any sort of accuracy from lines of this order. Therefore he set himself at once to think of squares, and his first map was known as a *plate carrée* projection, on which he showed rectilinear meridians and parallels, the scales of latitude and longitude being the same. But it became very quickly obvious that a map of that kind was far from being correct because, as he sailed with his compass, he found himself pursuing a different line from what the map had shown him. The consequence was that his navigational troubles were serious until Gerardus Mercator came along and suggested that these lines should be drawn not to form squares, but to form rectangles increasing in meridional dimension towards the Poles. Under those conditions the sailor could have the directions given by his compass shown truly as straight lines on the map. That represented very great progress, but the whole idea was to get straight-line working, graphically simple.

Two hundred years or so ago the same idea was applied by Jacques Cassini for the purpose of land surveying. There was nothing military about it in the first instance. The idea was to have something which surveyors could use comfortably, since surveyors were up against the same difficulty of using curvilinear co-ordinates as the sailor had experienced. The consequence was that surveyors also wanted a rectangular system; in other words, they wanted a grid such as a child could understand on a draughtboard.

That is a very old story, and what Brigadier Winterbotham has shown to-day is simply a modern form of the same thing. That grid system of projection is now so universal that in a number of our Dominions and Colonies a plan of any property must have the rectangular co-ordinates annexed. The grid which Brigadier Winterbotham has shown on the screen is nothing more than a linear representation of the co-ordinates about which he has been speaking, and the consequence is that the ordinary surveyor in dealing with property is able to make surveys in a simple manner, without having to introduce the difficulties of latitude and longitude. That really is the great function of the grid; to regard it as an essentially military system is merely to display ignorance.

May I suggest that in place of the ugly word "kilo-yard" the word "milleyard" would be more suitable?

Mr. A. R. Hinks: It must be about twenty-five years ago that an old friend of mine, who was then Savilian Professor of Astronomy at Oxford, referred to the time when every lamp-post in London would have on it its rectangular co-ordinates, so that if one was lost in a fog or anything of that sort, one would be enabled to discover one's exact locality. I am glad to hear that his idea is at last on the way to realization.

The question as to how this grid can be used for civil purposes seems to me to have got a little bit mixed up with the question as to what is the convenient size of square. If you are going to project any map originally referred to latitude and

longitude, you naturally calculate the rectangular co-ordinates of the intersections of the meridians and parallels and plot on squared paper. The squared paper on which you plot is in effect the grid. The number of lines on the squared paper in the actual sheet depends upon a variety of circumstances and has nothing to do with the merits of the grid as a grid.

In order to examine those merits closely at home I ventured to ask the Director General of the Ordnance Survey to give us the grid co-ordinates of the front door of the house of this Society in Kensington Gore. Our front door is 1,138,583 yards east of the point of origin—that is, the south-west of the Scillies—and it is 1,305,808 yards north of the point of origin (I leave out the decimals of the yards). Now, I think we do not want in the case of an ordinary house like this to put on our notepaper this position of the house to the exact yard, but to have it within the nearest hundred yards might be useful. Also, we do not want to know its position in regard to that fictitious point of origin at the Scillies. Therefore one can eliminate what is uninteresting at the beginning and unnecessary at the end. I take it therefore that for ordinary purposes if we wanted to use this grid reference in London we should cut off the first two figures, and certainly the last figure, leaving the position to the nearest 10 yards. But I would suggest that it is necessary for civilian use always to work in decimals of a figure representing 1000 yards. We want to think, not in yards, but in thousand yards, in another word, in the kilo-yard. We use the yard rather than the metre, and I believe there is a sufficient reason for this in the fact that the yard is, after all, our national standard of length.

I was a member of the committee to which Colonel MacLeod referred that reported it would have been an advantage if a hundred years ago we had adopted a metric system. It would have been a practical advantage to have the same weights and measures as other people. But it certainly would not be a desirable thing to make a compulsory change of this kind now. We can use metres now when convenient, but I do not find myself in agreement with Colonel MacLeod on the point of introducing the metric grid upon our maps. It is entirely logical to use the yard as the unit of length, because it is the national unit.

The word "kilo-yard" has been called a bastard word; it is certainly not a pretty word, but it is not fair to dislike it because it has the appearance of a hybrid. Before taking up this matter, I took the precaution to consult two classical scholars, and I wondered whether the word "kilo-yard" would shock them. To my surprise they were neither of them shocked. One of them pointed out that "kilo" is not Greek, the Greek word being χίλιοι, meaning one thousand. If the proposed word had been "chilio-yard" that would have been horrible; but "kilo" is a mere convention, meaning one thousand, and is not Greek nor any other language. Therefore to such terms as "kilogram" and "kilowatt" there can be no objection. As for talking about "mille-yard," I would differ from Captain McCaw, because the Latin prefix is used commonly for the sub-division of the unit, and therefore to talk about "mille-yard" as meaning a thousand yards would be in practice confusing.

Captain McCAW: "Millennium."

Mr. HINKS: Millennium is not a unit of length.

It does seem to me that when we get this map of London it will be the best possible demonstration of the value of the grid, and I hope that it will be possible to engrave the grid reference on the Society's notepaper. Of course our own House is relatively easy to find, but if we take some Gardens, for example, in the Kensington neighbourhood, the grid reference might well be very useful. It would be useful also for post offices, police stations, and theatres, enabling them

to be found without wasting time. I should like to express my own personal opinion that in ten years' time we shall find the grid reference in London of the very greatest importance. I think that is all that I have to trouble the meeting with at the moment.

The PRESIDENT: One would, of course, like much more time for the consideration of this subject, for the necessary criticism of it—I mean criticism in the proper sense, not destructive. All of us will agree with one of the opening sentences of Brigadier Winterbotham's paper when he said how useful this grid might be in the hands of the man in the street. By "the man in the street," I presume he meant the man in the country or on the country road. I will come to the question of its application in the streets of London later. Then Brigadier Winterbotham went on to indicate how it would be applicable in making a meeting-place, and so on, about which there could be no mistake. It was a great surprise to me when I heard Brigadier Winterbotham and also when I read to you just now Sir Charles Close's notes to find that they both spoke of the 1-inch map, the $\frac{1}{2}$-inch map, and then suddenly leaped—or the Brigadier did—to what he called the 10-mile map. I presume that what he meant was the one-tenth map. It is just as well to be consistent in this matter. A 10-mile map would presumably be 10 miles to the inch. If you use a grid, the side of which is 5000 yards, and put it on to the map, the miles do not, and indeed cannot, coincide with the squares; but I do not know that that matters. I am of opinion that, as Sir Charles Close has said, though it may spoil the aesthetic form of that beautiful map, for instance, that has been produced of Plymouth, it is a distinct advantage to the present map reader that he should have a number and a letter to mark the different sections. At the same time I have to realize, as Brigadier Winterbotham has pointed out, that difficulties arise when it comes to the use of different scales of maps. What is necessary, if this grid is coming in as a national grid, is that we should start at the bottom and see that the children in schools are taught how to read it. I do not suppose that any of us here this afternoon found difficulty in reading the grid; it is a thing we could learn to use in five minutes. But it is absolutely necessary, and a part of the business of such a Society as ours, that if this is coming in, the children should be taught to use it, and just as much what it means. I am entirely against the standardization of children's minds, but there are certain things in which uniform teaching is necessary, and this is one of them.

I must say that I cannot think that this grid would be useful inside a town. I should dine very early if I was going to trust to a taxi driver getting me to the theatre by the method of directing him in such numbers. Speaking seriously, I cannot imagine that if every street were labelled and properly planned you would be able to find your way from place to place in a town by the use of a grid system of this kind so well as you would find it by the ordinary reference to the names of the streets. We have been told that this grid will be in common use in London in ten years, but I should think it will be a much longer time than that.

I hope no one will use either the word "kilo-yard" or "mille-yard." Mr. Hinks has pointed out that "kilo-yard" is not even a word which combines elements from two languages—it seems to belong to no language at all. The prefix "kilo" is a bastard in itself. Why not say a thousand yards?

With regard to the military business, I think that must be a mistake. What the objector must have meant was military precision, and not what is usually called militarism.

But what Brigadier Winterbotham has done has been to bring before us something which is being made use of, which is coming in very largely, and which in many respects will be of the very greatest use. I hope that it will be ensured that the Education Department, and such other departments as have to do with

teaching, will have a chance of seeing how they may make use of it. But, having got this admirable fox to run, I will express a purely personal opinion, the hope that Brigadier Winterbotham and his colleagues will not run it to death by making use of it in every conceivable measurement and place and line.

I hope that Brigadier Winterbotham will accept our very best thanks for coming, especially at such short notice, and giving us a most interesting account of what to most of us must have been quite new.

Brigadier WINTERBOTHAM: I would break one metric lance. It might have been perhaps a good thing if one hundred years ago we had adopted the metre, but it is a blessed thing that we have not. The yard however decimally divided, would be a much greater boon than the metre.

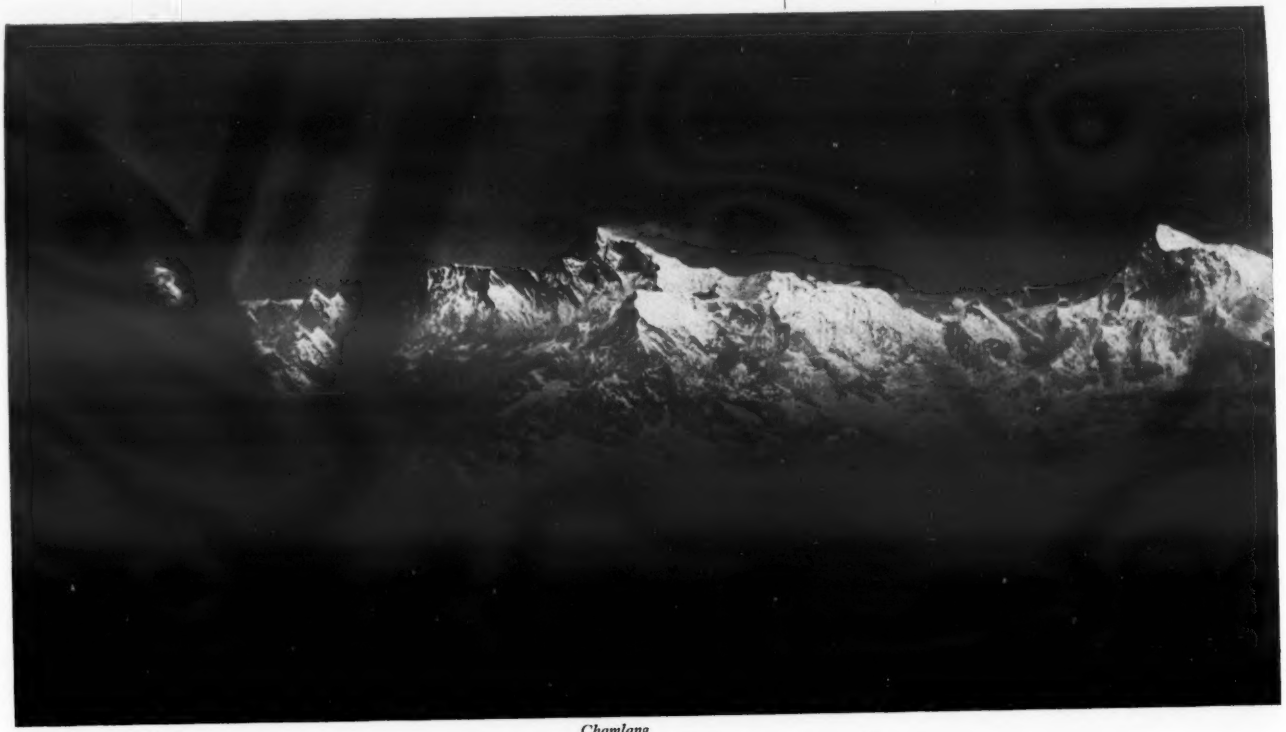
The PRESIDENT: I should like to break many lances with the Brigadier, but I will come down to Southampton and see him there one day.

PHOTOGRAPHS FROM THE MOUNT EVEREST FLIGHT

THE photographs taken on the Mount Everest flight were of four kinds: verticals overlapped in strip with two Williamson Eagle automatic cameras; obliques with two cameras of focal length $8\frac{1}{2}$ inches; obliques with a "pistol" camera; and kinematograph film, both standard size and 16 mm. Squadron-Leader the Marquess of Clydesdale piloted the leading machine, the Houston-Westland, with Colonel Blacker as observer on both flights. Flight-Lieut. McIntyre piloted the supporting machine, the Westland Wallace, with Mr. Bonnet as observer on the first flight and Mr. Fisher on the second. Each machine carried five cameras in all, for verticals, obliques, and film. The verticals have somewhat limited pictorial value, because they are rather unintelligible without a stereoscope; but they are destined for a great experiment in mapping by the improved Arundel Method, which is being carried out under the direction of Colonel Macleod, Chief of the G.S.G.S. It will be of much interest to see how far this relatively simple method can deal with country of such extreme relief. The focal length of the Eagle camera lenses was such that the side of the square of ground covered by the 5-inch square film was equal to the altitude of the aeroplane above that ground. Thus the successive exposures covered from, say, 20,000 feet square on approaching the mountain to 500 feet square above the summit of Mount Everest. Hence the range of linear scale is extreme, and the Arundel Method will be pushed to its limits.

The kinematograph film will probably be of great use in filling in the spaces between the obliques and providing the necessary connection between them when they do not overlap; but this is for the future.

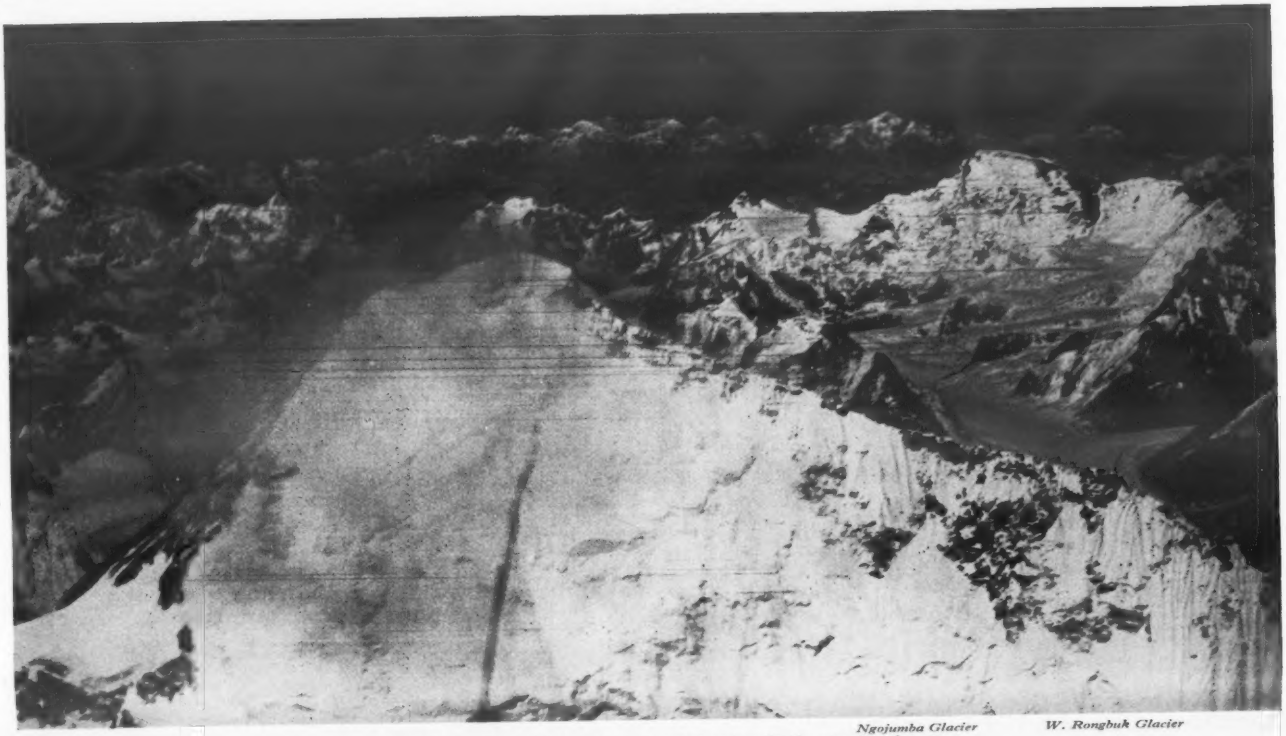
The first interest for geographers is to make as much as possible of the obliques, which range far over complicated mountain country, of which what maps exist (*e.g.* the new Nepal $\frac{1}{4}$-inch) do not pretend to represent the characteristic detail. By the kindness of Colonel Blacker, who took most of these plates, and by courtesy of *The Times*, which is the owner of the copyright, we are able to publish a small selection of these pictures, with such identifications



1. *Mount Everest and Makalu from the south*

Photographs from the Mount Everest Flight
"The Times" World Copyright

Gaurisankar *Gosainthan* *Cho Uyo*



Ngojumba Glacier *W. Rongbuk Glacier*

2. *The summit of Mount Everest from a little south of east*

as are at present possible. Mr. Bonnet took No. 5 on the first flight and Mr. Fisher No. 7 on the second.

In judging these plates one must remember that the observer shared with the pilot responsibility for the vertical survey camera fitted into the floor of the machine, and was wholly responsible for the film cameras. To take the obliques, in his spare moments, he had to stand up out of the cockpit in the slip stream, in a wind of effectively 120 miles an hour and a temperature of about −40° C. He was involved in electrically heated clothing, wearing an oxygen mask and goggles, and connected to the pilot by telephone leads and to the machine with a multiplicity of heating leads and oxygen pipes. His hand-held oblique camera had no automatic change: it was a question of taking out and slipping in the ordinary dark slide; and he had no time to make notes of the subjects on which he exposed. Moreover, the machine was not built to give a view for obliques clear of wings or tail, struts and engine. Nor could the pilot always afford to deviate from his course in order to give clear views of what the observer wished to photograph. In these circumstances Colonel Blacker and his colleagues did remarkably well to obtain so many excellent obliques. The exposures are generally well judged. The definition on a few plates is affected by vibration of the machine and in others by the rather unintentional proximity to the summit on the first flight, and consequent very rapid motion of the nearer objects across the field of view. But some of the plates which are less good technically have given the most interesting results.

The expedition had permission to fly over Nepal but not over Tibet, and this restricted their activities precisely to those sides of the mountain which have remained unknown to successive Mount Everest expeditions. Apart from one or two close-ups of the actual summit we have therefore no pictures of the northern face of the mountain familiar to the climbers, and only distant views of Tibet by peeping over the shoulders of Mount Everest from the Nepal side. None of the well-known landmarks just north of the mountain are to be seen: no picture of the North Col or upper part of the East Rongbuk glacier: no picture of the Kama Valley from above, nor of Lingtren. In the brief minutes available the attention of the observer was naturally directed towards the summit, and it was impracticable to take pictures on the opposite beam because the machine was banked to give a view of the summit. Also there was on both visits a very strong westerly wind which made it inadvisable to steer west of the mountain within the limits of Nepal, and we have consequently no pictures of the western face.

Permission to fly over Nepal was limited to direct flights to Mount Everest and back to Purnea. The very high wind on the second flight made it necessary to set a course considerably to the west until near the mountain, and to this fortunate impediment we owe the very interesting pictures from the south-west that make the same country look so very different (cf. Plates 1 and 7). But essentially the flight was confined to a narrow strip there and back. One acknowledges with gratitude the liberality of the Nepal Government in acceding to the flight; but one must regret that with all this skill and equipment it was not permitted to fly in from a station westward and down the whole range of the Nepal Himalaya with the wind. The first flight was over dust haze rising unusually high, to 19,000 feet; on the second flight a cloud layer filled

2. The summit of Mount Everest from a little south of east *Ngojumba Glacier* *W. Rongbuk Glacier*

the valleys to about 16,000 feet. The machines were on both occasions quite invisible to the people of Nepal. They passed unseen if not perhaps unheard, and the perfection of the flights almost without incident, and no more than a piece of routine flying, as one pilot said, may encourage us to hope that the way to further air survey of the unknown Himalaya westward is not so firmly closed as it was.

But meanwhile we have to make the best of an admirable if limited series of photographs, and a first difficulty is to find known points to make the necessarily acute resection of the air position. The longest diameter of the plate is no more than 32°, and the fixed points immediately recognizable on many plates: the summits of Makalu, Mount Everest, Gyachung Kang, and Cho Uyo, do not make a good fix for the distant air position because the angle subtended by the extreme points is no more than about 20°, and some of the critical air positions are too near a circle passing through the visible fixed points.

The triangulation diagrams of the Survey of India for sheets 72 I and 72 M give, south of the mountain, eleven points within 20 miles of the summit, intersected from stations of the geodetic triangulation, of which only seven have heights determined; and eight points from minor triangulation, of which six have heights. One or two more can be inserted from the recent $\frac{1}{4}$-inch map of Nepal. But it is a long business to make certain of their identity upon the photographs, which show ten times as many peaks in the area, some more conspicuous than those intersected, since the peaks which happen to be visible from distant stations of the triangulation are not necessarily the highest. For a long time it was doubtful which point of the long ridge of Chamlang was Pk. 42/72 I in the cumbrous numbering of the Survey, or which point on the Eastern Ridge of Mount Everest is Pk. 38/72 I. Most of the points have now been provisionally identified upon the photographs; but this part of the work belongs rather to a later stage than that of the present paper, which is a general examination of the series, with the more obvious identifications and brief commentary.

We have examined prints of twenty-four obliques of the principal series of the first flight and nineteen of the second. From these we have selected seven of the first and three of the second for reproduction here; but the commentary is based upon the whole series. We have for the present avoided asking to be allowed to see the verticals or the kinematograph film, preferring to discover what can be made of a set of obliques; for this is a problem which will often be presented in the future. At an early stage Professor Kenneth Mason remarked that some of the photographs could be paired for the stereoscope, and since then many pairs have been studied, first with a Barr and Stroud Field Stereoscope lent by Colonel Macleod, and later with the Wild stereoscope belonging to the Society, which has the advantage of magnification, and for these photographs full of complex detail is much superior. The stereoscope resolves the pictures into wonderful perspectives of peaks and ridges. The perspective is of course distorted, since the axes are not parallel; but nevertheless the resolution is of striking value. We hope to publish later some of the photographs with the peaks and ridges lightly outlined, to bring up the relief. Meanwhile it will be seen that the following commentary owes much to the stereoscope.

3. The summit of Mount Everest and last section of the north-east ridge

4. Makalu seen over the summit of Mount Everest

5. The south-western arête of Makalu

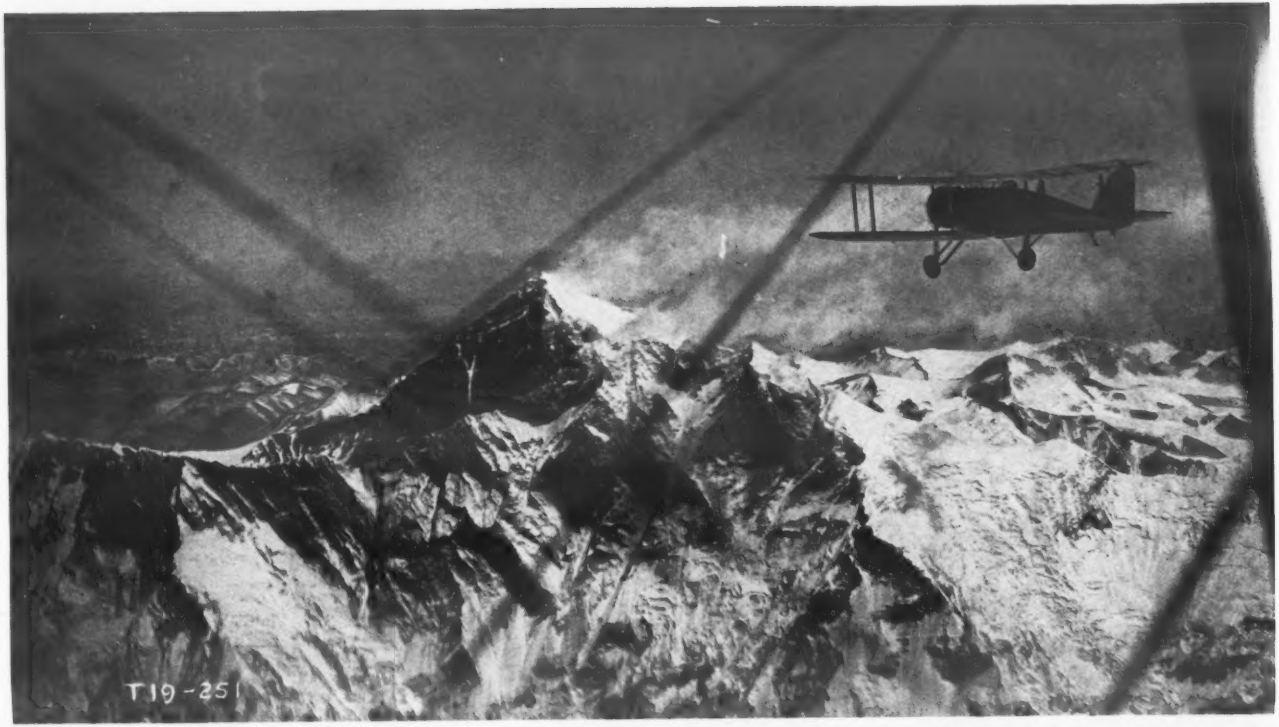
Gosainthan *Mount Everest* *East Rongbuk*
West Rongbuk

Barun Khola

6. Mount Everest from over Makalu

Rongbuk valley

The Houston-Westland aeroplane
Head of Kharta Valley



Nuptse

7. The south face of Mount Everest

1. *Mount Everest and Makalu from the South. Distance perhaps 40 miles.*

The course was set for the summit, but the drift from the strong west wind required that the nose should be pointed about 18° off the objective: hence it was possible to take this picture forward through the bracing wires of the wings.

The skyline to the right of the summit is the Eastern Ridge descending from Lhotse, shown in Phot. 14 by Colonel Howard Bury (*Geogr. J.*, February 1922) with the back of the great eastern cwm, with Khartapu showing over its shoulder. The south-eastern face is snowclad and rather uniform, like the north-eastern face seen from Kamachangri in H.B. 13 (*l.c.*). A south-eastern arête divides it sharply from the south face, which is cut into by immense ravines between black triangular buttresses. The stereoscope shows that the great western ridge turns through an angle of about 60° at the top of the triangular buttress snowclad below. The identity of the point labelled Lhotse in H.B. 14 and 16 is not yet clear: and probably that called Lhotse in H.B. 3 is another summit farther west. The high-pointed peak on the left between the centre section struts is not Pumori.

From near the summit of Makalu a sharp arête descends south-west with a conspicuous oval scar on its southern flank. A southern arête descends to a second peak about 26,000 feet and turns sharply west. A deep valley runs from north-west to south-east south of Makalu behind a range of about 22,000 feet, connected by a sharp lower ridge with the north-east end of the 24,000-foot ridge which seems from a greater distance to run like a hog's back to the summit of Chamlang. But the stereoscope shows that the darker portion in the centre of the ridge is a deep cut bordered by ranges that run out south towards the camera. The pistol camera plate 155 shows this gorge running almost directly towards the summit. Behind Chamlang and to the right is another 24,000-foot peak, probably Pk. 39/72 I. The deep valley to the left running away south-west is the upper part of the Hongu Khola (Khola = river-valley).

2. *The summit of Mount Everest from a little south of east*

The north-east ridge, just below which on the far side is the route followed by Norton and Somervell in 1924, and two parties of this year's expedition, leads to a triangular snow slope, well seen in Somervell's picture No. 13 (*Geogr. J.*, December 1924), on what has been called the "final pyramid," but is now seen to be a sharp crest running round a kind of cirque. The points on the north-east ridge are hard to identify in terms of the "first step" and "second step" used in 1924.

To the right is the head of the West Rongbuk Glacier. Comparison with Somervell's photograph No. 15 of December 1924 shows that Pumori and Lingtrennup are hidden. The bigger glacier coming in second on the right is from the glacier basin east of Gyachung Kang. The broad glacier pass, the Nup La, to the head of the Ngojumba glacier, is just beyond this junction, and all the glacier beyond drains into the Dudh Kosi. Gyachung Kang is out of the picture to the right. Directly behind Cho Uyo lies the Nangpu La at the head of the Kyetrak glacier explored by Howard Bury in 1921. Gosainthan is about 70 miles away, and Gaurisankar on the extreme left of the picture about 35. Colonel Howard Bury and Mr. Wollaston made a great circuit in

7. *The south face of Mount Everest*

Nuptse

this country in 1921: see map in *Geogr. J.*, February 1922, and 'Mount Everest: the Reconnaissance.'

The bearing of the axis of this picture is about 284°.

3. *The summit and last section of the North-East Ridge*

We look down on the latter part of the route between Camp VI and the summit. Brigadier Norton has said that he can "identify every rock," and that the point which he reached in 1922 is about half an inch left of the wing tip. The steep pitch beyond has up to the time of writing (June 10) defeated in succession, Wyn Harris and Wager, and Smythe and Shipton. The "second step" is probably on the ridge to the left of the tip; it is half as far again from the summit as the point indicated above. The "first step" is not in the picture. The southern ridge of the western cwm is on the left: the point of snow on the crest is probably the peak of the triangular buttress mentioned in 1, where the ridge turns sharply. The stereoscope shows that the dark range just below the line of snow peaks in the right background is double: it must be the double ridge enclosing the unnamed river running south-south-east to Namche Bazar (Nepal $\frac{1}{4}$-in. 72 I), and one of the peaks on the nearer ridge is Khumbila (19297). The deep valley of the Dudh Kosi (coming from Gyachung Kang) is on the near side of this ridge, but on the other side of the nearer jagged peaks to the right of the summit, of which the highest is apparently Taweche (21388). The high snow peaks on the skyline, provisionally identified in the margin, lie west-south-west of Namche Bazar. Between them and the dark ridges is the valley of the Bhote Kosi which carries the track to Tingri over the Nangpu La, by which friends of the porters used to come up from Nepal in 1922 to visit the base camp. The identification is provisional, because the photograph is steeply tilted and canted, and the relative heights of peaks are a little difficult to reconcile with the $\frac{1}{4}$-inch map; but the positions seem to agree well with the map and with the azimuth deduced by overlaps carried from Gaurisankar.

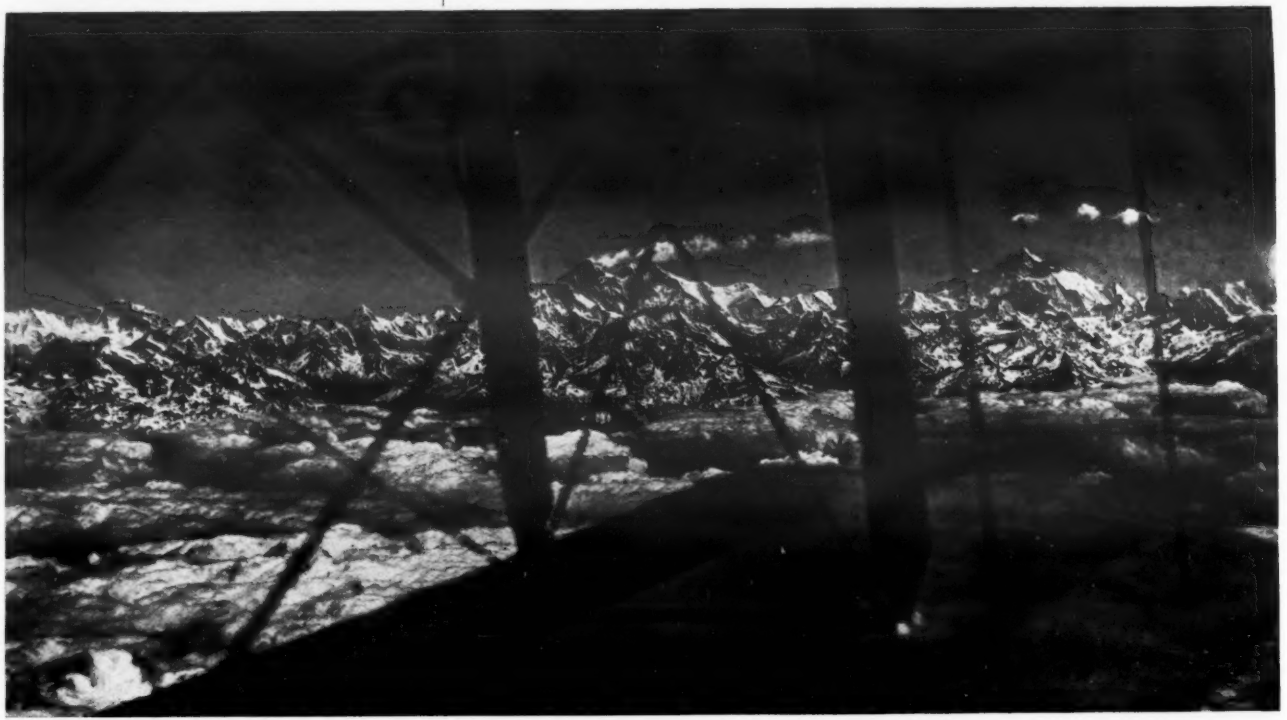
4. *Makalu seen over the summit of Mount Everest*

If we compare the snow patches of the summit with photographs 3 and 10 we see that we have in this picture two facets of the summit: that facing north-west is bounded by the line of snow patches running down from the summit to the right at 45°: the second facet to the right must face a little south of west, and is seen very obliquely in No. 7. The hitherto unknown south-west ridge of Makalu, seen in No. 1 and in No. 5, runs down to the right. The west-north-west ridge running towards the lower left-hand corner of the picture and all the detail of the great basin to the left can be identified with H.B. 16. The ridge running away high to the left joins Makalu with Chomo Lönzo, which is just out of the picture. The distant peaks are on the other side of the Arun Gorge.

The great cirque at the end of the East Ridge of Mount Everest (H.B. 13) can be seen dimly through the cloud in line with Makalu. Pethangtse is near the left edge, and above it the double peak to the east of Pethangtse (H.B. 13).

5. *The South-western Arête of Makalu*

This fine picture of the south-west arête of Makalu can be compared readily with its aspect from the south in No. 1 and from the west in No. 4. The large



8. Mount Everest and Makalu from the south-west

9. *Chamlang from the north*

10. *Chamlang over the summit of Mount Everest*

oval marking to the right immediately identifies it, and with careful allowance for the plunging view all the principal details on both sides can be compared step by step. The farther ridge running away to the right of the summit is the ridge to the left of the summit in No. 4; it leads to Chomo Lönzo, the peaks of which are hidden behind Makalu. Kharta Shika lies about 4 miles on the near side of the Phung Chu or Arun in the dark valley on the top left of the picture. The mountains beyond the Arun Valley, at the extreme top of the picture, are Nyönno Ri (22, 144) and Ama Drime (21,882), respectively 40 and 35 miles beyond the peak (Tibet ¼-inch 71 P.).

This picture was taken by Mr. Bonnet on the first flight.

6. *Mount Everest over Makalu*

On the right is the head of the Kangshung Glacier, and over it one looks down the middle range of the East Rongbuk Glacier. One can make out the great cirque at the head of the Kangshung Glacier which is seen against the north-east ridge of Mount Everest in Wollaston's pictures Nos. 12 and 20 of the *Journal* for February 1922. Above the foreground summit in the picture is the great cirque at the eastern end of the east ridge of Mount Everest (H.B. 13). The glacier to the left is at the head of the valley of the Barun or Chukchu Khola running south of Makalu.

The summit is probably that of Makalu. Its outline agrees with the reverse profile in No. 4: but we have not succeeded in identifying detail with that on the two ridges to the right of the summit in No. 5.

On the western ridge of Mount Everest one cannot see beyond the triangular buttress, and comparison with No. 1 will show how sharp is the angle at this buttress on the south face of the ridge. West of the ridge one sees the head of the West Rongbuk and Gyachung Kang. Compare No. 2. The mountains on the skyline are north of Gosainthan, of which the north slope appears on the extreme left edge of the picture.

There is a whole series of obliques taken by Colonel Blacker on the return from Makalu on the second flight, and these can be combined in pairs with the stereoscope to give a beautiful account of the detail between Mount Everest and Chamlang, which in No. 6 is largely hidden by an accidental defect.

7. *South face of Mount Everest*

The point of snow on the left of the west ridge is Nuptse. Over the ridge we look down the main Rongbuk Valley, and the sharp bend at the white buttress hardly shows. We look over the ridge into the western cwm and along the south summit ridge and western face, of which the tip is shown on the right of the summit in No. 4.

Two immense blocks are seen in the stereoscope to be projecting as if they had slipped and been held. The stereoscope also shows very deep ravines between deep triangular buttresses. The peak at the top of the south-eastern arête is probably what has been called Lhotse from the Kharta side (H.B. 14). The dark peak at the south end of the south summit ridge is probably what is called Lhotse from the West in Mallory No. 4 (*Geogr. J.*, December 1922). Much detail on the right at the head of Kharta Valley can be identified with the aid of Colonel Howard Bury's photographs.

The aeroplane is the Houston-Westland with Lord Clydesdale and Colonel

Blacker. The picture was taken by Mr. Fisher in the Westland-Wallace on the second flight.

8. *Mount Everest and Makalu from the south-west*

A very high westerly wind made it necessary to go a long way west of the mountain before approaching it, and several pictures give details of this country west of Mount Everest which is the background of No. 3 seen in the reverse direction. Gyachung Kang is on the skyline left behind the wire, then comes the pointed peak seen in No. 1, and the round-topped mountain on the left strut must be Pumori; this is the only photograph on which we have found it. The deep valley running behind the left-hand strut is Bhote Kosi, and the valley running down from the direction of the summit towards the left strut is the Imja Khola, which joins the Dudh Kosi near Namche Bazar. Chamlang is hidden behind the right-hand strut. All the country to the right of this strut just beyond the clouds is that seen projected against Chamlang in No. 1, and it will be possible to determine a great number of minor peaks. The dark valley on the right is that of the Barun Khola seen on the left in No. 6.

9 *and* 10. *Chamlang from the north*

No. 9 is a picture which has been difficult to identify. The dim hills in the distance at the top and the direction of the shadows show that one is looking south. The key to the identification is found in No. 10. The background is very similar, and comparative detail of the mountain on the left shows that it is the same as the central peak in No. 9. The triangular pattern along the left-hand ridge is conclusive.

Now No. 10 has the north-west face of the summit of Mount Everest in the foreground, and we are looking south. The detail in the middle distance is a crest somewhere above the big gables seen in No. 7. The difficulty was to reconcile the background of No. 9 with the picture of Chamlang from the opposite side in No. 1. The distant snowy ranges of No. 9 look too high, but this can be explained by the very steep inclination of the camera axis. We have already noted that the stereoscope shows ridges running south from Chamlang in No. 1, but are inconspicuous in the direct view, and shows also that there is a ravine cutting through the ridge of the patchy part in the middle. By good fortune one of the pistol camera plates shows on its extreme edge a view up this ravine which cuts through the Chamlang ridge obliquely and points directly to the summit of Mount Everest. This is the ravine on the extreme left of No. 9. The same aspect of Chamlang from the north can be seen rather vaguely in H.B. 13, and much better in other unpublished panoramas made by Col. Howard Bury in 1921.

Such are the results of a preliminary study of the photographs taken on the Mount Everest Flight. The material was discussed with Col. Howard Bury, Brigadier Norton, and Prof. Mason. The first draft of the conclusions was submitted to the Marquess of Clydesdale, Colonel Blacker, and Flight-Lieut. McIntyre, and they agree that there is nothing in them inconsistent with their observations and recollections of the flight. The fuller identifications here given have been examined by General Bruce, Colonel Strutt, Dr. Longstaff, and again by Colonel Blacker, who concur. We may hope then that the ground is now clear for a further and more precise study of the material. A. R. H.

THE MOUNT EVEREST EXPEDITION

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IN the May *Journal* the departure of the expedition from Darjeeling in two parties on March 6 and 8 was described. The last definite news then was of the arrival of the second party at Yatung. The following account of their further progress is taken from Mr. Ruttledge's subsequent dispatches to the *Daily Telegraph*.

The two parties joined forces at Gautsa and went on together to Kampa Dzong, which they reached on March 29. They rested four days there and, following the old route past Tinki Dzong and Shekar Dzong, six long marches apart, reached the Rongbuk Monastery, where they received the blessing of the Lama. The march had gone very much according to plan in spite of such difficulties as cold and snow upon the passes, a natural consequence of their early start from Darjeeling.

Base Camp was reached on April 27 and preparations for pitching the higher camps were at once begun. With the help of some of the local Tibetans Camp I was established on the 21st. The route to Camp II was prospected on the 25th, the camp was occupied next day, and climbers went on to begin a reconnaissance of the glacier as far as Camp III; but the stores were not moved up farther until the two lower camps had been fully supplied. This policy of making each camp completely self-supporting before moving on to the next had the double advantage that it minimized the dangers consequent on prolonged blizzards and also allowed the climbers to become gradually and thoroughly acclimatized to the increasing altitude.

Camp III was finally established by May 5. The party took particular care to make themselves comfortable, for it was here that the 1922 Expedition suffered so severely in bad weather. Two of the arctic tents were erected, the third being reserved to be pitched a little later at the foot of the North Col for the benefit of the climbers who were engaged in cutting a safe route up the ice wall. These arctic tents are built in the shape of an Eskimo igloo. They consist of a framework of eight light ash poles, rising vertically from the ground and curving inward to join at the apex like the ribs of an umbrella. Their framework suspends, by a number of 6-inch tapes, an inner tent of light canvas and supports an outer covering of much heavier material. Light is supplied by talc windows and ventilation by an adjustable in-draught of fresh air through the doorway and an out-draught of warm air through a vent at the apex. They are 12 feet in diameter and 8 or 9 feet high, so that there is plenty of room for eight men to sleep in each.

The construction of a safe route up the North Col proved somewhat difficult. Bad weather hindered the climbers, but on May 12 a party led by Smythe and Shipton succeeded in reaching a platform within 400 feet of the top of the Col. It seems probable that this is the same platform which was used for Camp IV in 1924 but has since moved downhill. The old route of 1924 had completely vanished and the ice slopes it followed were swept by avalanches, but after steps and ropes had been fixed on the new route it was considered safe except immediately after bad weather.

This camp was established on May 15, and five days later Wyn Harris, Birnie, and Boustead with ten porters tried to reach Camp V but were driven back by bad weather. On the same day Mr. Ruttledge came up to Camp IV and from then onwards he made the North Col the advanced base instead of Camp III. Thus he was in more intimate contact with the highest camps and yet he could communicate with Camp III by field telephone. Here was stationed one of the signals officers who transmitted his dispatches by wireless to Base Camp whence they were retransmitted to Katapahr above Darjeeling and so by land line to Calcutta.

A remarkable feature of this expedition is that its centre of operation has been higher up the mountain than ever before. From May 21 to June 1 between six and ten out of the full complement of fourteen men were always at Camp IV or above it, and, as will be seen, Camps V and VI were advanced up the mountain respectively 650 and 700 feet higher than in 1924.

Camp V was established on May 22 by Wyn Harris, Greene, Birnie, and Boustead, supported by twenty porters. Wager and Wyn Harris accompanied the party for training purposes, and their presence proved useful, for Longland escorted down one of the porters who could not stand the altitude, while Wager changed places at Camp V with Dr. Greene, who found himself insufficiently acclimatized, and returned to the North Col. Greene refreshed himself from an old oxygen cylinder found on the way: this is the only record we have had so far of the use of oxygen on this expedition, but it was no doubt taken to the higher camps for emergency use.

With Camp V established Mr. Ruttledge could begin to work out his plans for a final assault. The arrangement was to send two climbers with a small supporting party to sleep one night at Camp V. Next day they would establish Camp VI, and the supporting party would take the porters down to Camp V, where a second party of climbers would have already arrived. On the third day the first couple would attempt the summit and return to Camp V while the second party moved up to Camp VI to act as a support in case of accident and to be ready to make an attempt next day. Thus, provided the weather was good, two, and possibly three, attempts could be made on consecutive days. After that the camps would probably have to be restocked with provisions.

Smythe, Shipton, Birnie, and Boustead slept the night of May 24–25 at Camp V, but strong winds prevented them from reaching Camp VI, and on their way down next day they met Ruttledge, Wyn Harris, Longland, Crawford, and Wager, who were moving up in support. The whole party descended to Camp IV for the night. This was Boustead's last climb, for, owing to the expiration of his leave, he has had to return to the Sudan. Smythe and Shipton were then rested, but next day Wager and Wyn Harris with Birnie and (probably) Longland went back to Camp V. On Monday, May 29, Wager and Wyn Harris with Longland in support climbed to Camp VI; Smythe and Shipton moved up to Camp V and Crawford and McLean to Camp III. Ruttledge had retired temporarily to Camp III.

Camp VI was established near the first step of the arête at 27,400 feet. Longland then took down the eight porters and Wager and Wyn Harris slept in the camp. They were off soon after dawn next morning. Between their camp and the first step they found an ice-axe which probably belonged to Mallory,

Irvine, or Somervell. It is not quite clear whether they climbed to the ridge itself, but in any case they traversed below the second step and entered the couloir about the same place that Brigadier Norton did in 1924. Snow blanketed the ledges, and before they had reached the face of the final pyramid the climbers decided that too little time remained to reach the summit. They went back to the second step to find out if it could be climbed or traversed on the other side. We are not told the verdict that they gave to Smythe and Shipton whom they probably met at Camp VI, but presumably it was unfavourable, for when, on June 1, the weather allowed another attempt to be made, Smythe and Shipton followed the same traverse route below the second step.

After about two hours' climbing Shipton became unwell and returned to Camp VI, but after a rest he was able to go on down through a blizzard to Camp V. Smythe meanwhile went on alone. He followed Norton's route to the couloir, but here he was stopped, like Wager and Wyn Harris, by the difficulty of climbing on snow-covered ledges and by the rocks on the left wall of the couloir. He went back to sleep his third night at Camp VI, and next day, June 3, descended through very bad weather to Camp IV. At Camp V he picked up Shipton and also Birnie, who appears to have lived at this camp since he went up with Wager and Wyn Harris on May 28. Mr. Ruttledge waited to receive the party at Camp IV and then took every one down to Camp III to rest and discuss their future programme.

The result of this conference is given in a dispatch dated June 11. Every member of the climbing parties was slightly frost-bitten, and all, except Smythe, had dilated hearts. Since this medical report coincided with the breaking of the monsoon and fresh falls of snow, Mr. Ruttledge decided to take the whole party down to Base Camp to rest there until the weather improved. In the course of the monsoon periods of good weather do occur, and Mr. Ruttledge intends to take advantage of one of them to send Smythe, Wyn Harris, Shipton, Longland, Crawford, Brocklebank, and Greene once more up the glacier. The first four named will make two parties for a final assault. Shipton and Longland, who has had a wide experience of guideless rock climbing, will try the second step direct. Thus, if they are successful, they will avoid the couloir; but if this proves too difficult both parties will try Norton's route again.

Apart from the last message no very definite news with regard to the weather is available. The period between the establishment of Camps III and IV was certainly stormy, but it appears that the party suffered no hardship. The first attempts to establish both Camp V and Camp VI were frustrated by bad weather, but Wager and Wyn Harris made their assault in still though cloudy weather. Smythe and Shipton were checked for one day by wind and made their attempt when Camp VI was hidden by cloud or snowdrift from those below. Early monsoon conditions seem to have been prevailing as high as Camp IV, but higher up the weather was better. In a dispatch dated June 2 Mr. Ruttledge said "The slopes of the Col are still safe despite the monsoon current." This was the day on which Smythe and Shipton attempted the summit. There is no mention of wind above Camp VI, though a little below it a blizzard was blowing both on that day and the next.

Since the party are now resting the state of the weather is only serious

because too great a snowfall would hinder the climbers later on. Provided the weather improves and the climbers regain their condition the best chance of reaching the summit seems to depend upon a direct ascent of the second step, for there can be no doubt that the traverse of the couloir, at least when the rocks are covered with snow, is difficult enough to occupy a large proportion of a man's climbing time.

As Mr. Ruttledge said, the failure of the two attempts so far must be attributed solely to climbing difficulties, for a study of the table given below will show that the expedition wasted no time in getting into position for their first assault.

			1924	1933	
Base Camp	..	16,500 feet	established April 29	April 17	
Camp I	..	.. 18,000 „	„ „ 30	„ 21	
„ II	..	.. 19,500 „	„ May 2	„ 26	
„ III	..	.. 21,000 „	„ „ 8	May 2	
„ IV	..	.. 23,000 „	„ „ 20	„ 15	
„ V	..	.. 25,000 „	„ June 2	„ 22	(25,650 feet)
„ VI	..	.. 26,700 „	„ „ 3	„ 29	(27,400 „)

12 *June* 1933.

JOSEPH FISCHER'S PTOLEMY REPRODUCTION

CLAUDII PTOLEMAEI GEOGRAPHIAE CODEX URBINAS GRAECUS 82 (Codices e Vaticanis selecti, quam simillime expressi, jussu Pii XI, P.M. Volumen XVIIII). Tomus Prodromus. De Cl. Ptolemaei vita operibus geographia praesertim eiusque fatis. By JOSEPH FISCHER, S.J. Pars prior. Commentatio. xvi+606 *pages*. Pars altera. Tabulae Geographicae. xii+83 *pages*. *Maps*. (Facsimile-Reproduktion.) Pars prior. Adnotatio critica. By PIO FRANCHI DE CAVALIERI. 40 *pages; textus* [154] *pages*. Pars altera. Tabulae Geographicae. viii *pages and* Plates I–XXVII (Codex Urbinas Graecus 82), XXVIII–LIV (Codex Vaticanus Latinus 5698), LV–LVII (Codex Urbinas Graecus 83). *Lugduni Batavorum* [*Leiden*] *: E. J. Brill; Lipsiae* [*Leipzig*]*: Otto Harrassowitz* 1932. *Size of first three volumes* 14×9½ *inches; of the fourth volume* 29×20 *inches*. *M*.760

THIS monumental work, eagerly awaited by all who knew the years of research devoted by its learned author to its preparation, in no way disappoints the high expectations raised by Professor Fischer's reputation as one of the foremost modern students of Ptolemy and his geographical work. It forms a fitting crown to the labours of a lifetime, and it is hardly too much to say that it marks the greatest step yet made towards solving the many problems which confront the student of the Alexandrine geographer. The learning displayed is immense, extending not merely over the whole of Ptolemy's work and the MSS. through which it has come down to us, but equally over the whole field of previous criticism, with the details of which the Professor shows himself thoroughly at home. Only the most recent discussions of special points by Hermann, Honigmann, and others appeared too late to be taken into account in the body of the work, so that they could only be dealt with briefly in a supplementary section. On one or two points they may lead the author to modify his original conclusions, but these appear still to hold good in the main. They are based on so well-balanced a critical judgment as to be nearly always convincing, even when, as not unfrequently happens, they involve a rejection of certain views of previous commentators. Few indeed are the students competent to undertake a serious criticism of such a work, and all that can be done here is to present some of the more interesting facts and conclusions which emerge from a first reading.

The work takes its place as vol. 19 of the great series of reproductions of Vatican MSS., and is produced in the same sumptuous style as its predecessors. Its central feature is the complete photographic reproduction of the fine Ptolemy MS. known as Urbinas Graecus 82, judged by Fischer to be the most important of all that have come down to us, though not entirely free from errors of transcription. It was not to be found when Carl Muller made his careful examination of Ptolemy MSS. when preparing his critical edition of the text (never, alas, completely finished) which suffered to some extent on this account. The first two parts of the present work ("Tomus Prodromus"), in quarto format like the third, consist respectively of an elaborate monograph on the life and works of Ptolemy (particularly the geography and its fortunes through the centuries) and of 83 reproductions of specimen maps from various MSS. The last two parts give the text and maps of the Urbinas in facsimile, the former on a slightly reduced scale, the latter in the full size of the original, each sheet of which is over 22 inches high. This involves the largest folio format, with pages measuring some 29 by 19 inches, and the volume is somewhat awkward to handle, but the greater legibility so secured is ample compensation.

In a short introduction to the first volume Professor Fischer sketches the genesis of his great undertaking, proceeding in Book I to discuss Ptolemy in turn as a man, a geographer, and a cartographer. For his life-history the most definite data are supplied by his great astronomical work, the 'Almagest.' Piecing together these with scattered notices by Greek and Arab writers, and carefully examining the conclusions of previous commentators, the Professor shows that the following points are pretty well established. Ptolemy probably lived from about A.D. 90 to 168, the statements of various writers that he lived on into the reign of Marcus Aurelius (though all his scientific work was done in the reigns of Hadrian and Antoninus Pius), and that he was seventy-eight at death, being apparently trustworthy. The earliest and latest certain dates for his own observations are A.D. 127 and 141, and the 'Almagest' was completed before 147–8, as proved by the inscribed pillar in the temple of Serapis. His other chief works—the 'Tetrabiblos,' 'Geography,' and 'Astronomical Hand-tables' (the last an independent work, though this has not been generally recognized)—were written later, in this order. Most of his observations were made, as he says himself, at Alexandria, but this was not necessarily his birthplace, though the common idea that he was born at Pelusium seems to have arisen through a misreading of the Arabic form (*Keludi*) of his first name Claudius: on the whole it is most probable that he was born at Ptolemais Hermeiu. His supposed Semitic origin has no valid support, and the friend to whom he dedicated some of his works was one Syros by name, rather than a Syrian.

In considering his qualities as a geographer the author takes in order the four works which had more or less bearing on geography, beginning with the 'Almagest.' This supplies the mathematical foundation for the 'Geography' proper—actually foreshadowed in the earlier work. It lays down, *inter alia*, the spherical form of the Earth and its character as a mere point in the stellar universe; defines the main parallels of latitude as determined by the length of the longest day; gives the successive angles made by the ecliptic with the Earth's axis; and so on. The 'Geography' which was to follow, and which must have been written after A.D. 141, was to contain a list of the chief towns in the several provinces, and to define their latitudes and longitudes in reference to the Equator and the meridian of Alexandria respectively. It was not to break with the past, but to carry on and extend the work of the best previous authorities. Although much criticism of the 'Almagest' has been indulged in, Fischer thinks we may agree with Manitius—translator into German (1912–13) of the critical edition of Heiberg, 1898–1903—that, granted that Ptolemy was no good observer, still the solid and conscientious way in which he raised his own superstructure on the foundations previously laid, should save him from the reproach of being a mere compiler and plagiarist. It is true nevertheless that he was not always judicious in his choice of material, mixing together items of very different value.

The authenticity of the 'Tetrabiblos' (or Quadripartitum) so long the standard work on Astrology, has been often questioned, as it was thought impossible for a man of his calibre to be a devotee of so fallacious a science. But of his authorship there is now no room for doubt. Even this has much geographical and ethnographical matter (contained in the second book), since the influence of the stars was thought to depend on the physical and mental characters of peoples, and these in turn to be affected by geographical position. We therefore find an elaborate ethnographical scheme of the *Oikoumene*, extending south to the Equator. The primary division is into four parts, defined by parallels and meridians, each part corresponding to three of the signs of the zodiac. The scheme is far from complete, but this is not due to defective knowledge, but is explained by the closeness with which Ptolemy followed Posidonius in the main.

A certain independence of his authority is shown by Ptolemy, who is led into error however by his attempt to fit the facts into a mathematical framework.

The 'Geography' (as it is usually called) is naturally treated at greater length, with a detailed analysis of the methods and ideas of its author. The title *Γεωγραφικὴ ὑφήγησις* is more correctly translated "Introduction to Map-making," this being the purpose kept in view throughout. Of the general authenticity of the text, once questioned, there is now no possible doubt, though the maps are on a different footing. A question of prime importance is the relation of Ptolemy to Marinus, about whose work we depend entirely on Ptolemy's own statements. He makes no secret of his indebtedness to him, nor is sparing of praise of his scientific method. Much new material had come to hand since the work of Hipparchus, Eratosthenes, and Posidonius, and this had been carefully worked up by Marinus, who had discussed afresh the extent of the *Oikoumene*, the relations of land and water, the basis of map-making, and so on. Ptolemy has been blamed for following Posidonius and Marinus in their under-estimate of the Earth's circumference, but he did this only after very serious consideration, though unfortunately he gives no critical discussion of the matter. Fischer is disposed to adopt the explanation (for which there is some evidence) that Posidonius used a *stadium* standing to that of Eratosthenes in the ratio of 3 : 4. Anyhow he adopted what was the latest and, as it seemed, most trustworthy result. While following Marinus in this, Ptolemy by no means blindly accepted all his conclusions (for example, as to the extent of the habitable world), but showed by just criticism where Marinus seemed to be wrong. He was careful to add to the latter's data by inquiries among sailors and others—for instance, with regard to the more distant parts of Asia and East Africa—and he says that his conclusions were based in part on personal investigation. He did not, as is sometimes said, throw all his data into one promiscuous heap, but was at pains to distinguish the three classes of more or less accurately fixed positions—a fact missed by those who have merely studied the Latin editions of his work.

The true character of the 'Astronomical Hand-tables,' and their geographical importance, have only lately been recognized, for no trustworthy text has been available, and the tables of positions of important places given in the work have been confused with the tables in the eighth book of the 'Geography': Fischer's study of them is therefore of special value. A fundamental difference consists in the choice of the Fortunate Islands in the astronomical work as the starting-point of longitude in place of Alexandria. But while other differences from, and additions to, the tables in the eighth book are to be noted, there is closer agreement with the data in the earlier books. The later tables may perhaps be regarded as an enlarged and improved version of those in the 'Geography,' based largely on new information, although some recent critics regard the additions as interpolations by another hand.

It is on Ptolemy as cartographer that the most valuable new light has been thrown by the Professor's researches. By his unrivalled knowledge of the MSS. he is in the best position to attack the secular problems: (1) Did Ptolemy himself accompany his 'Geography' with maps? (2) If so, do those which have come down to us represent his originals at all closely? He is able to show that the oldest and most trustworthy MSS. either contain maps or refer to the presence of maps in their models. As moreover Ptolemy distinctly avows his purpose of giving an exact cartographical picture of the inhabited world, we may conclude that the maps were from the outset an essential part of the work. This being so, the authorship of the maps we know would hardly have been doubted were it not that several of the most important Greek MSS. contain the statement that Agathodaemon, a "mechanic" of Alexandria, mapped the whole world on the

basis of Ptolemy's eight books. All the maps have therefore been attributed by many writers (beginning with Vossius in the seventeenth century) to this otherwise unknown author, though many good authorities have taken the other view, holding that the maps were Ptolemy's own or made under his direction. Fischer's conclusion, which since first put forward has been very generally accepted, is as follows. Apart from the world-map, the maps we know all agree closely with the data of the 'Geography': the world-map does not, and this only is to be connected with the Agathodaemon legend.

Put briefly, the main reasons for this view are as follows: Ptolemy's text leads us to look for three general sketches of world geography in map form, one being merely the centre-piece of an armillary sphere. The existing general map in no way accords with what is said of these: it contains much more information and is on a different projection. It could not have been based on Ptolemy's text only, but many data have evidently been taken from the special maps—another indication that these existed from the first. It may have been that Agathodaemon had undertaken a complete revision of the work, and substituted his map for the original ones, but it is enough to suppose it recommended by its greater simplicity of construction, and the more complete geographical picture which it supplied.

In discussing the purposes and methods of Ptolemy in making his regional maps, Fischer carefully compares these maps, as found in Urbinas 82 and other early MSS., with the text (1) of the eighth book, (2) of Books II–VII. From the text we know that, according to the extent of information available, the special maps were to be drawn on different scales, and the rectangular projection chosen differed from that of the world-map. The number of maps assigned to each continent in the eighth book, and the points laid down as requisites, agree exactly with those found in MSS. of the Urbinas group, though there is disagreement in the positions of places, to be explained perhaps by the retention in the text of old positions regarded as fixed astronomically. It is quite inadmissible to suppose that Ptolemy thought the maps of Marinus good enough for continued use, since we are expressly told that these needed much correction, and the mistakes are in fact corrected in the maps still extant.

Comparing the existing maps with the text of Books II–VII—a task now first made easy by the present reproduction—Fischer shows how impossible it would have been to construct such maps, later, from the text only, as they give many details not found there, and there are differences both in the form of the names and in the positions assigned; and while text and maps agree in distinguishing three categories of towns (the maps by means of "vignettes" of different form) there are discordances in points of detail. On the other hand, though it is obvious that the text could not have been written without maps as its basis, it is equally certain that the text could not have been made up from the maps we know only. The marked differences between the text of Book VIII and of Books II–VII are held to be due to the different point of view adopted, the author writing in the eighth book as an astronomer for astronomers, in the other as a geographer for geographers. Apart from the different prime meridian the positions differ greatly, and it is remarkable that while in their general form and arrangement the maps follow the plan of Book VIII, the positions agree rather with those of the other books. Ptolemy was content in fact to put down side by side the results reached by two different methods, making no attempt to harmonize them. Fischer regards this as no demerit, as such an attempt could have rested on no sure foundation.

In the second book the Professor enlarges upon the subject which he has made so peculiarly his own—the history of the work through the centuries, and the

mutual relations of the MS. versions which he has so carefully studied. It is a long story, and many points of interest must necessarily be omitted.

It is now well known, from the researches of Carl Muller and others as well as Fischer, that the known MSS. fall into two main groups—according to Fischer, those with twenty-six and those with sixty-four regional maps, the units in the former being "lands," in the latter "provinces" or "satrapies." These are designated the A and B "redactions" respectively, and as Urbinas 82 belongs to the former, it is to this group that special attention is paid (a future reproduction of one of the B-group being foreshadowed), while codices without maps are left on one side, though they form the larger number. Many codices with maps must have been lost, for instance both Urbinas 82 and another early Greek version in the Vatican contain indications that they were copied from prototypes marked by certain peculiarities, and their loss is much to be deplored. In the Urbinas and a good many others the table of contents gives references to the pages or columns in which the several sections were dealt with in the prototype. One of the best authorities, the Vatican Librarian Dr. G. Mercati, considers this to prove that the prototype must have been written in Egypt, where a similar numbering of columns is found in papyrus rolls written in the first centuries of our era, and this is borne out by the Egyptian names of the months given side by side with the Greek ones. This takes us back to a time not very remote from Ptolemy's.

The relation of the Latin to the older Greek MSS. is fully discussed, particularly the way in which the Greek MSS. first found their way to Italy about 1400, there to be copied and translated. On the strength of contemporary notices (some previously little known) it is shown that this important service was primarily due to the noted Italian patron of letters, Palla Strozzi, who brought over the Greek scholar Chrysoloras to Florence, together with (among other Greek MSS.) a Ptolemy of large format provided with maps. This came from Constantinople, and was thought to be of great age. Chrysoloras seems to have begun translating the MS. into Latin, but not to have completed the task. As is well known, this was done by his pupil Jacobus Angelus, and Fischer shows the date of completion to have been 1406. Angelus dealt with the text only, while the maps were taken in hand by two almost contemporary Florentines, Francesco di Lapaccino and Domenico di Boninsegni, who multiplied copies of both text and maps in the same large format as the Greek originals. Fischer bases these conclusions mainly on statements of the slightly later writer Vespasiano da Bisticci, but in an "excursus" supplied by Dr. Mercati the accuracy of that author is considered open to question. Mercati deals also with the question what were the actual Greek MSS. used by the above-mentioned scholars, and whether Urbinas 82 was one of them. He is inclined to think that it was the actual copy owned by Strozzi, but is more doubtful whether it was also used by Angelus, or that it was the "very ancient Greek MS." used in revising the text for the Rome-printed edition of 1478. Anyhow there must have been two, if not three, Greek MSS. in the hands of Italians in the early years of the fifteenth century.

After a general view of all the known MSS. with maps, the author proceeds to a detailed description of each of the A group, both Greek and Latin, beginning with Urbinas 82. Careful examination by experts has shown its date to have been probably the late twelfth or early thirteenth century, and there is good reason to think it the actual MS. seen and admired by Vespasiano da Bisticci in the library of Duke Federico of Urbino, after passing through the hands of Strozzi. (With the rest of the Urbino library it came finally to the Vatican in 1657 by decree of Pope Alexander VII.) To describe it in any detail is here impossible, but a few points may be noted. The world-map is on the projection with straight meridians

used for the early editions printed at Rome, though it differs from any printed version in some features—in representing the signs of the zodiac, giving both the Greek and Egyptian names of the months, and stating the length of the Equator and the more important parallels. In both this and the regional maps the bright blue sea is divided from the land by black lines, while provinces, etc., are separated by red lines where not divided by mountains and rivers. They are also distinguished by colour-washes. The exact position of places is shown by a red point or small red cross and their rank by vignettes of varying form. The text contains a number of additions to that of Ptolemy, some derived from Strabo, and these are a help in tracing the influence of the MS. on later ones.

The Mount Athos MS., a comparatively rough production, is placed second on the list, being probably of the early fourteenth century. Differences from the Urbinas show that it cannot have been copied directly from this, though there is plainly some relationship. An important Greek MS. which offers some difficult problems is one in the Laurentian Library at Florence, which Fischer at first held to have been written in that city a little before 1454 by the Thessalian Johannes Scutariotes, a conclusion since abandoned: it seems to have belonged to the library of Antonius Corbinelli, who died in 1425, and by a will of the previous year left his books to the Monastery of S. Maria in Florence. It shows both resemblances to, and differences from, the Urbinas.

Coming to the Latin MSS., the first in order is one containing maps only, now in the Vatican, which stands alone in this class in exactly reproducing the town-vignettes of the earliest Greek MSS., and it shows so many resemblances to Urbinas 82 that it must have been copied either from it or from a common original. There are reasons for thinking it the very MS. made by the son of Palla Strozzi and presented to King René I of Sicily—a transaction of which Fischer has unearthed some interesting particulars. For convenience of transport, text and map were forwarded separately, and it is thought highly probable that the text corresponding to the present maps is to be found in a MS. preserved in the Bibliothèque Nationale. The whole series of Latin MSS. is divided into seven groups, four of which are represented respectively by examples drawn by Nicolaus Germanus, Pietro Massaio, Francisco Berlinghieri, and H. Martellus Germanus. Many interesting facts are brought out, but only a few can be mentioned. The MSS. of Nicolaus, in their three successive recensions, were marked mainly by the adoption of a new projection and by a reduction in size. One of the first recension is found to have been the basis of the printed Bologna edition of 1477, just as the maps in the printed Rome editions were based on another, the Codex Ebneriensis now at New York. The sources of the modern maps added are discussed, as also the changes introduced into the ancient maps, making some hardly recognizable as Ptolemy's. The Massaio group includes the fine MS. in the Bibliothèque Nationale reproduced a few years ago (a copy of the reproduction is in the Society's library). Massaio followed the older MSS. more closely than did Nicolaus, but like him introduced features into the world-map taken from the special maps. Particularly interesting is the conclusion, based on strong grounds, that the Wilton Codex, twice sold in London within the past twenty years, and now in the Huntington Library (see description in the *Journal*, vol. 64, p. 237), was also the work of Massaio and possibly the earliest set of the maps drawn by him.

In regard to the Berlinghieri group again some little-known facts are brought out. One is apt to think of Berlinghieri solely as author of the metrical paraphrase of the 'Geography' printed at Florence somewhere about 1480, but we now learn that besides two signed Italian MSS. of this work (with the maps), he was also responsible for two fine Latin MSS., unsigned, of the 'Geography' proper.

All four show the same peculiarities of style, with finely executed miniatures, so that there is little room for doubt that all came from the same hand, though the influence of Massaio is also to be traced: it is suggested in fact that Massaio and his colleague Comminelli may have been employed by Berlinghieri. From a comparison of the Italian MSS. Fischer holds that the version now at Milan must have served as the main source both of its fellow now in the Vatican, and of the printed edition. He also shows that the date of the latter, often put down as 1478, must lie between August 1481 and the spring of 1482.

This summary has already reached undue proportions, and the subject of the last book, the influence of Ptolemy in later times, must be hurried over rapidly. Among the Greeks and Byzantines, the most important follower of Ptolemy, at an interval of little more than a century, was Pappus of Alexandria. His geographical work has been largely ignored, being now lost, but its substance may be gathered from the avowed use of it made later by the pseudo "Moses of Chorene," who says that Pappus had based his work on Ptolemy's maps. This is fully borne out when we compare the text of Moses with the maps we know. Only so, in fact, can the origin of that text be explained, for while its general arrangement conforms well with Ptolemy's maps, it shows little resemblance to his text. Among the Syrians, Bishop Jacob of Edessa (late seventh century), in the geographical part of his commentary on Genesis, was clearly following Ptolemy, whom he names as one of his authorities, and he too must have known maps as well as text. Among the Arabs the most important copyist of Ptolemy is of course Al-Huwarismi, whose MS. work has been judiciously dealt with by Nallino and Von Mžik. Although certainly based on Ptolemy, it shows a good many differences, but very little new information. Its direct prototype may have been either a Syrian or an earlier Arabic version. The Roman writer Ammianus Marcellinus was another plagiarist of the 'Geography,' whether directly or through an intermediary like Pappus. Finally, in the Renaissance, the great work was once more popularized by men of German origin like Nicolaus and Martellus.

Fischer makes no claim to have said the last word on Ptolemy—in fact he considers that the intensive study of that geographer is only beginning. He is certainly helping this forward by making an authoritative text available to students for the first time.

EDWARD HEAWOOD

Note.—It should have been mentioned above (p. 65) that the fourth part of the work includes a complete reproduction of the twenty-seven maps of the most important Latin MS., also in the Vatican, as well as those of the Urbinas 82.

REVIEWS

EUROPE

TO INTRODUCE THE HEBRIDES. By IAIN F. ANDERSON. *London: Herbert Jenkins* 1933. 8×5 *inches; 308 pages; illustrations and sketch-map. 7s 6d*

The Hebrides will, alas, in time become as fashionable as the Mediterranean. Even now you may go on circular tours during the summer in moderately comfortable steamers. And here, for one such cruise (as far south as the Mull of Cantire, as far west as St. Kilda, and as far north as Skye) is an admirable guide-book. It is full of exactly the kind of Baedeker-historical information that an intelligent circular tourist will need. The historical comments are particularly good. And the book keeps to the point. You learn about each place as you pass it. And you learn more at the ports of call where you may go ashore for a few hours' exploration. There are other books about the Hebrides, many others, chatty books, scientific books, and books in which appropriate croonings and dreamings and yearnings combine to produce that rather bogus poetry that is so astonishingly unlike the real Gaelic poetry or the real Gaelic country or the real Gaelic people. In these pages you are given a little of that, but not too much. Mr. Anderson, who is honoured by a foreword from Kenneth MacLeod, of Gigha, has no Gaelic himself, but this really does not matter, because on so general a cruise of inspection the tourist cannot expect even to begin any acquaintance with the islanders. A map at the beginning shows the route. A time-table at the end shows the hours between island and island. The last chapter but one will be considered too elementary by the increasing numbers of voyagers who are interested in ornithology. To them it will seem shockingly careless of Mr. Anderson not even to have mentioned the quite common White-winged Black Guillemot with its brilliant scarlet legs and feet, not to have admired the airy flight of the Sheerwaters, nor heard one single Raven saying "Cronk, cronk" overhead. As to the photographs, the frontispiece and a few others are admirable. But too many of them have been printed with horizons all askew. K. H.

A DETECTIVE IN ESSEX: landscape clues to an Essex of the past. By DONALD MAXWELL. *London: John Lane* 1933. $7\frac{1}{2} \times 5$ *inches;* xii + 174 *pages; illustrations and sketch-maps. 6s*

As in other volumes of this County Detective series the chapters fall under so many Clues. The two first bring into prominence the villages, only 30 miles from London, of Good Easter and High Easter, whose names come in for close scrutiny. Under the Clue of the Smugglers' Towers, which refer to Fobbing Church in the Thames estuary, we hear about the great days of smuggling amid the maze of hidden tortuous creeks only to be navigated by native pilots. The mediaeval charm of Thaxted up in the chalk hills of the north-west is well depicted, but the description of its church as "without doubt the most beautiful in the world" need not be taken too seriously in a book designed in lighter vein.

Against a weight of opposition Mr. Maxwell stoutly defends the theory of "leys" or "sighting lines" of the prehistoric surveyors, making much of the straight alignments of the various hill-top settlements of south Essex, now the sites of churches like Stanford-le-Hope. He claims to have found one or two lost sites with the joint aid of leys and place-names. We miss a Clue, or even a reference, to the still unsolved riddle of the Red Hills or Salting Mounds on the outlandish archipelago of Foulness and elsewhere by the tidal creeks.

The author contrasts the enthusiasm of people who realize that Essex is a picturesque county, with the ignorance or blindness of those who think it uninteresting. Essex may not boast any exceptional standard of natural beauty, but it has strong individuality, and we hope that this book will help others to discover for themselves the diversity of its landscape, the fascination of its lonely coastal marshes, and the beauty of the western woodlands that in Epping Forest stretch close up to London. L. C. W. B.

NEUES LEHRBUCH DER GEOGRAPHIE. By MAX ECKERT. II. Teil. Erste Hälfte. [Europa]. *Berlin: Georg Stilko* 1933. $9\frac{1}{2} \times 6\frac{1}{2}$ *inches;* xii + 599–1130 *pages.* *M.*14.50

The first part of this general geography was noticed in the *Journal* for July 1932. The present volume deals with Europe, divided into Central, Eastern ("Europäisch-Halbasien"), Northern (peninsula and island Europe), and Southern. A system of division which brings together the British Isles and Franz Josef Land, and places France with Central Europe, obviously requires considerable modification. The section on the British Isles is full of misconceptions and of errors in the spelling of place-names, so that it fails to inspire confidence in the remainder. Germany receives one-quarter of the book. The sections on political geography are inspired by strong nationalistic feeling. As in the earlier volume, there are no sketch-maps, but quite extensive bibliographical references. G. R. C.

ETATS DE LA BALTIQUE. RUSSIE. By P. CAMENA D'ALMEIDA. (Géographie Universelle. Edited by P. VIDAL DE LA BLACHE and L. GALLOIS. Tome V.) *Paris: Armand Colin* 1932. $11\frac{1}{2} \times 8$ *inches;* 356 *pages; illustrations and maps.* 100 *fr*

In preparing the series of volumes for the Géographie Universelle, one of the hardest tasks of all has fallen to Professor d'Almeida. Although he starts with the immense initial advantages of knowing the Russian language and of having spent several considerable periods in the country, the material does not exist for a comprehensive survey of the whole of the vast territories of the U.S.S.R. On the one hand there are huge tracts still unexplored, as the discovery by Obruchev of the Chersky Mountains—exceeding in grandeur and elevation even the Caucasus—as recently as 1926 has proved. On the other hand there is the extreme difficulty of eliminating from recent literature, especially that dealing with economic aspects of geography, all bias and propaganda. In face of these difficulties Professor d'Almeida has succeeded in giving by far the best account of Russia existing in any language of western Europe, illustrated as in the other volumes of the series by excellent and well-selected photographs and maps. The most disappointing section of the volume is the first thirty-three pages, in which the author dismisses Finland and the three Baltic States. There exists a very extensive geographical literature relative to Finland and what is probably the finest of all national atlases. By virtue of the country's position, the detailed geography of Finland forms an index or key to that of neighbouring parts of Russia. Yet little or no use is made of this material; no mention is made of the unique work of the Finnish Geographical Society in many directions such as in the mapping of "landscape" forms and regions. The interesting linguistic and population problems, the development of the primitive Lapp communities; the transport problems and the northward expansion of Finland to the open Arctic, the contrasted physical regions, the nature and causation of varying types of forest and consequent effects on exploitation, the relationship of settlements to soils and aspect are all subjects which entirely escape attention.

But it is the sections on Russia which occupy the bulk (300 pages) of the volume. There is a general section on European Russia, stressing particularly the physical background, followed by a description region by region. The next sections deal respectively with Siberia and Russian Central Asia, and there is a concluding general account of the social and economic situation under the Soviet régime. The problems of transport and communication and the inter-regional exchange of commodities which are of such outstanding importance rather escape attention. But these must be regarded as mere blemishes in a work of outstanding value, which includes scientific investigations carried out in the last fifteen years, the results of which have only been available previously in the Russian language. The investigations of the Geological Commission however, especially on coal, seem to have escaped attention. Finally, a feature of permanent value is the explanation given of local descriptive names and other terms.

L. D. S.

ASIA

RUSSIA AND ASIA. By Prince A. LOBANOV-ROSTOVSKY. *New York (and London): The Macmillan Company* 1933. 9×5½ *inches;* viii+334 *pages.* 14s

This is a history of Russian exploration and expansion in Asia, written by an exiled Russian nobleman who is Assistant Professor of History in the University of California at Los Angeles. It is a straightforward narrative of events which, with the brilliant exception of Baddeley's 'Russia, Mongolia, and China,' have been sadly neglected by English historians. It is to be feared that in this country Russian colonial history has never received the attention due to its historical importance, chiefly because Russia, advancing overland, did not cross the path of English imperialism until the nineteenth century. But Russian power had reached the Pacific across Siberia as early as 1647, and a few years later had engaged in armed conflict with the Manchu-Chinese Empire on the Amur.

Yermak, Khabarov, and the other Russian conquistadores of the sixteenth and seventeenth centuries were men of the stamp of Cortes and Pizarro; they show the same mixture of greed and piety (but rather less piety), the same audacity, toughness, and ruthlessness, and the same confidence in firearms for ascendancy over numerous, but ill-armed, foes. With the new era of Russian history begun by Peter the Great scientific exploration on the Western model was undertaken, and was carried on with great energy and ability during the eighteenth century under the auspices of the Academy of Sciences founded in 1726; the tracing of the Arctic coast of Siberia and the discovery of the Bering Strait and Alaska were its outstanding achievements. Bering's expedition of 1725 disproved the idea that America and Asia were joined; on the other hand, curiously enough, the belief that Sakhalin was joined to the mainland persisted until 1849, and it was not until after Nevelskoi's voyage in that year that the Russians penetrated southward along the Pacific coast from the Sea of Okhotsk into the Sea of Japan, and finally founded Vladivostok in 1860.

In 1916 Kuropatkin wrote in a confidential report to the Tsar: "By drawing the border line from the Khan Tengri range [of the Tian Shan] in a direct line to Vladivostok, our frontier will be shortened by 4000 versts and Kulja, Northern Mongolia and Northern Manchuria will be included in the Russian Empire." As the author of the present work remarks, "this programme has been partly carried out by the Soviet Government," that is, by the creation of the Soviet republics of Mongolia and Tannu-Tuva in what is still nominally Chinese territory and by the building of the Turk-Sib Railway which "being the only railway in the vicinity of Chinese Turkestan assures Russian economic domination of that

enormous area." As a Russian patriot, Prince Lobanov-Rostovsky cannot conceal his satisfaction at the success of the U.S.S.R. in carrying on the tradition of Russian imperialism, and he positively gloats over the industrialization of the Kusnetsk region (in the foothills of the Altai) under the Five Year Plan, whereby "Russia will be in a position to tackle her Far Eastern problems with much more vigour." However, Japan has not waited for this "much more vigour" of tackling, and her Manchukuo is a counterblast to Soviet Mongolia.

G. F. H.

KASHMIR: the Switzerland of India: a descriptive guide. By DERMOT NORRIS. *Calcutta: W. Newman & Co.; London: Forster Groom & Co.* [obtainable through *The Field*] [1932]. 7½×5 *inches;* 272+xii *pages; illustrations and maps.* 10*s* 6*d*

Many guide-books are of no practical value in the place or country itself but only of interest and use to a person whilst he is journeying thither. This book is really what a guide-book should be—a guide in and not merely a description of the place or country. A guide-book on Kashmir must give practical hints without which a stay may be marred. The publishers on the cover claim that Mr. Norris describes Kashmir from all points of view with a full knowledge of his subject. This is indeed a modest and true claim, for the author writes of Kashmir from all angles: mountaineering, fishing, skiing, large and small game shooting, and gives all the information that is wanted. It is easy to detect that this book has not been written with a slight acquaintance only of the country, or by an author who has refreshed his memory by reference to other guide-books, but that it is based upon an extensive practical knowledge.

Large houseboats are always available in Srinagar, but we are warned against the disadvantages of hiring one of these. The unwary could easily be led into taking one, only to find later how very much better it would have been to have hired two small ones. There is, in addition, a mine of other useful information about houseboats. Transport, which plays such an important role in the Himalayas, is fully dealt with by the author. Only those who have sat at the end of the Kharal bridge in the sun waiting for their porters to come back from Kargil, or who have had to make the detour of 6 miles there, will appreciate the importance of the hint on p. 87 to arrange so that this delay is avoided.

The book was printed in India and the "get up" and paper of it might have been better: the photographs are not good. It is however a book that should not be left out of the library of any one going to Kashmir: he will be well repaid for having included it. There is room for a more comprehensive guide to Kashmir, and the author could well fill a gap that is lacking in this respect. B. K. F.

INDOCHINE: ouvrage publié sous la direction de Sylvain Lévi [sous le patronage du] Commissariat Général de l'Exposition Coloniale Internationale de Paris. *Paris: Société d'Editions Géographiques* . . . 1931. Two volumes. 11×9 *inches.* (Vol. I.) [Descriptive], 232 *pages.* (Vol. II.) Documents officiels, 216 *pages; illustrations*

This important work is published under the patronage of the Commissariat Général de l'Exposition Coloniale Internationale de Paris. It is nothing less than an encyclopaedia of information concerning the French possessions in Indo-China—Tonkin, Annam, Cochin-China, Cambodia, and Laos—a territory comprising 735,000 square kilometres with a population of 20,000,000. The chapters are by various authors, nearly all of whom are members of l'École française d'Extrême-Orient at Hanoi. Volume I contains a detailed topographical description of each province together with an outline of history, ancient and

modern, and an account of the inhabitants, their languages, culture, and religion, and chapters on the literature, art, and archaeology of Indo-China. The second volume deals very fully with the administrative and political organization in all phases, with chapters on agriculture, forests, fisheries, mines, and industries. There is also an account of the functions and activities of l'École française d'Extrême-Orient, which was founded in 1898 by M. Paul Doumer, the then Governor-General. This institution, whose province is historical, archaeological, and philological research in Indo-China and the neighbouring countries of the Far East, has its headquarters at Hanoi, where its magnificent library is housed. It publishes a Bulletin which is an excellent source of information for the scientific study of Eastern Asia, and from time to time valuable works which are beyond the compass of the journal.

Hanoi is also the headquarters of le Service Géographique de l'Indochine, a special Government department which works directly under the Governor-General. It is divided into three sections: geodesy and astronomy; survey and cartography; revision and photography. Maps of the plains of Tonkin and Annam (1/25,000) have been completed and corresponding work on Cochin-China is in hand. The mapping of the mountainous areas (1/100,000) has been in progress since 1899. Tonkin and Annam have been almost completed, and the most important areas of Cochin-China and Cambodia, but so far only a small part of Laos has been mapped. General maps of Indo-China (1/500,000, 1/100,000, and 1/200,000) have been prepared by reducing the existing maps of already surveyed areas, and the remaining areas have been filled in from sea-charts, foreign maps, and reports of missionaries, explorers, and Government officers. Aerial photography has been used in surveying the delta lands of the Mekong River, where there are sometimes as many as twenty proprietors to the hectare, with good results.

It is surprising that in a work so comprehensive as this no maps should have been included; and with so much detailed information the lack of an index is a serious omission. On the other hand each chapter is well documented with extensive bibliographies, though small mention is made of books in foreign languages, and Sir Hesketh Bell's elaborate study, 'Foreign Colonial Administration in the Far East,' is too valuable a contribution to its subject to have been overlooked.

The illustrations, in colour and photogravure, are beautifully reproduced and add to the interest and value of this scholarly and monumental work. O. R.

AFRICA

TRIBAL STUDIES IN NORTHERN NIGERIA. By C. K. MEEK. 2 volumes. *London: Kegan Paul, Trench, Trubner & Co.* 1931. $9^{1}/_{2} \times 6$ *inches;* x+582 *and* viii+634 *pages; illustrations and map.* 25*s*

A SUDANESE KINGDOM: an ethnographical study of the Jukun-speaking peoples of Nigeria. By C. K. MEEK. With introduction by H. R. PALMER. *London: Kegan Paul, Trench, Trubner & Co.* 1931. $9^{1}/_{2} \times 6$ *inches;* xxxiv+548 *pages; illustrations and maps.* 25*s*

The appointment of Mr. C. K. Meek as Government anthropologist in Northern Nigeria has resulted in some interesting accessions to the ethnological literature. In quick succession have appeared his 'Tribal Studies in Northern Nigeria,' 1931, in two volumes, and 'A Sudanese Kingdom,' 1931. The former of these is devoted to the description of the cultural characteristics of more than fifty non-Muslim tribes in the Northern Provinces, covering a wide area of the

territory. The considerable mass of material brought together in the two volumes has been derived very largely from the author's own observations and field notes. The numerous tribes and sub-tribes dealt with are grouped according to their apparent affinities, language forming one of the important bases of classification; and a useful feature of the book is supplied by the vocabularies appended to the description of each tribal group. Such a book should prove valuable as a work of reference, useful alike to the ethnologist and to the resident administrator of native affairs, and it should go far towards helping to prevent those administrative blunders which have, with all good intention, resulted from imperfect knowledge of the customs and traditions of the natives, and from a failure to appreciate the "native point of view."

The fact that the author himself collected the greater part of the information which he has placed on record is advantageous, inasmuch as it has led to uniformity in the treatment of the material culled from the several tribal groups. The benefit of this will be recognized by ethnologists who wish to gather facts for the comparative study of special phenomena. In some instances his notes were unavoidably collected very hurriedly, owing to the short duration of his visits, not admitting of any full inquiry or of checking the results obtained; it remains to be seen how far the more hastily acquired information will be borne out by those whose contact with the particular tribes has been more prolonged. Still, in a book of this kind it is well that the author should include the whole of the data collected by him, even where circumstances militated against leisurely investigation; and Mr. Meek's training can be relied upon to keep him from any but minor errors, and should enable him to evaluate evidence even when obtained during a cursory survey. With many of the tribes Mr. Meek enjoyed reasonably prolonged contact, and he was able to reap from them a rich harvest of information, and he is thus able to take the reader well behind the scenes of native thought. His chief interest has been focussed upon sociological study, and the greater and more valuable portion of his text is concerned with tribal customs, social structure, beliefs, ritual, cults, and the like, as to which he furnishes valuable data, the collection of which does credit to him as a field researcher. A large number of excellent photographs, mostly taken by himself, adds value to the book.

Material culture is not Mr. Meek's strong point, and it is unfortunate that the arts and crafts are treated so cursorily, and that many of the sketches, done seemingly from memory, fail to convey any adequate idea of the nature and functions of the objects. The characteristic objects of native manufacture and use are as important, probably, as evidence of the intellectual status and the affinities of a people, as are the details of social organization, beliefs, etc.; and they have the advantage of supplying reliable evidence of a concrete nature, to be seen, handled, and described with full confidence. Hence their value to the ethnologist, and hence an ethnologist's regrets at the comparative neglect of such important diagnostic material.

In spite of this defect however the book will be welcomed by all who desire first-hand information for the comparative study of the culture, characteristics, and mental status of the tribes dealt with. A very useful map, showing the areas occupied by the various tribes, is appended.

Mr. Meek's second book, 'A Sudanese Kingdom,' is more closely focussed upon a single ethnic group: the Jukun-speaking peoples of Nigeria, the result of five months' close investigation of this confederacy of peoples, who now occupy an area lying between 7° and 10° N., and about 8° 30′ and 11° 40′ E., the centre of which is traversed diagonally by the Benue River. Although to-day the Jukun and their allies occupy a considerable extent of country, it would appear

that they formerly held sway over a far wider territory, extending far into what is now Hausaland, and that they exercised a dominant influence in the heyday of their prosperity, during the seventeenth century. Traditionally the Jukun were immigrants from Kordofan, a people of Hamitic or half-Hamitic descent, whose advent into Nigeria may provisionally be dated about A.D. 900–1000. Physically, the peoples now included within the Jukun-speaking confederacy are not homogeneous, and one may gather that the bond existing between the units in association is one rather of common language than of blood relationship. Ethnic fusions have wrought changes in habit, and metamorphosis in social structure may be seen in progress to-day, as, for instance, in the growing tendency to adopt patriarchal principles in place of the formerly predominant matriarchal system, a change which is especially noticeable among the urban Jukun. An able and enlightening Introduction to the volume, by Mr. H. R. Palmer, lately Lieutenant-Governor of the Northern Provinces of Nigeria, throws considerable light upon the probable origin and affinities of the Jukun and their gradual fusion with indigenous peoples who became subject to this ruling caste. Much is necessarily conjectural, but the joint researches of Mr. Palmer and Mr. Meek, as chronicled in this volume, have effectively cleared up much which was obscure in regard to this interesting people and their ethnological status. Mr. Meek has dealt very fully with the social structure, beliefs, rituals, superstitions, and government, in a series of chapters, and has brought to light many new facts. The economic life and material culture have received rather fuller treatment than in his other work already referred to, although some of the descriptions, through omission of reference to points of importance, are less clear than they should be, and there is room for improvement. No evidence is quoted in support of the statement (p. 435) that "Among the Hausa the cire-perdue method is commonly employed in the manufacture of swords." Is there any justification for this assertion? The musical instrument shown in Plate XIV is clearly a form of oboe and not a "clarinet," as described. It is difficult to interpret as a functional weapon the harpoon as sketched on p. 448, and also to feel convinced that the proportions of the bow depicted on p. 445 are actually as shown in the sketch. The photographic illustrations are very satisfying, both in quantity and quality, and the book as a whole is a valuable contribution to ethnological literature.

H. B.

THE GEODETIC LEVELLING OF CEYLON (1926–1929). Survey Department. Published under the direction of A. H. G. DAWSON, Surveyor-General. *Colombo: Ceylon Government Press* 1932. Two volumes. $14\frac{1}{2} \times 10$ *inches*. Vol. I. Report with Plates and Tables, etc. By T. Y. PRICE and A. L. GRICE. 22+xxxii *pages*. Vol. II. Abstracts of Primary and Secondary Lines of Levelling, 1926–1930. vi+138 *pages; diagrams and maps*

Although this report of the Geodetic Levelling of Ceylon (1926–1929) runs to but twenty-one pages of letterpress, the joint authors have provided a remarkably clear account of the operation. So much has already been written on the theory of levelling that the authors are wise to have concentrated on matters of practical detail which have sometimes been rather neglected in similar reports.

Volume I opens with the history of levelling in Ceylon prior to 1924, and the reasons for the decision to discard all previous work and start afresh. The next five chapters, or nearly half the volume, contain details of the instruments and type of Bench Marks used and a concise but complete account of the organization and field procedure. Reading these chapters one is struck both by the efficiency of the organization and also by the extreme rigidity demanded in the field practice. It is open to question whether some slight relaxation of this latter would

not have led to an acceleration of the rate of progress attained, and this question is discussed at some length by the authors. The resulting conclusion is that considering the difficulties inseparable from native surveyors and a tropical climate, the avoidance of repetition is more to be aimed at than the acceleration of progress by quicker, and consequently less reliable, observations. With this view we are inclined to agree.

The description of the field procedure ends with a short account of the night levelling found necessary under the traffic conditions of Colombo, and the methods adopted at the thirteen water-crossings encountered during the course of the levelling. The reliability of the results in the latter, employing reciprocal readings with 21-inch levels, is discussed, but it is a pity that the method by reciprocal observations of small vertical angles was not also employed in some cases, as comparison of the respective results would have been of great interest.

The remaining pages of Volume I are occupied by a chapter on errors which provides no new features, one on tidal observations which serves to explain why mean sea-level at Colombo during the period 1834–1890 was finally selected as the datum for this levelling, and lastly a concise but very lucid account of the final reduction of the level-net. There are thirty-two pages of tables and diagrams, of which the many examples given of "Discrepancy Graphs" are of particular interest.

Volume II is merely an abstract of the Bench Marks along the primary and secondary lines of levelling, but the very clear key-map at the end of this volume is worthy of notice. T. H. L.

NORTH AMERICA

HUMAN GEOGRAPHY OF THE SOUTH: a study in regional resources and human adequacy. By RUPERT B. VANCE. *Chapel Hill: The University of North Carolina Press* (*London: Oxford University Press*) 1932. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* xiv +596 *pages; maps.* $4.00 (24*s*)

This is an important work on a large-scale theme, yet in treatment, as in organization, it falls short of the expressed intentions of the author; and it is the more necessary to point out at the outset some real merits which it possesses. Such are the many aptly chosen and significant extracts from other writers which illustrate the subject matter and support the argument. Thus the reader who already has an adequate knowledge of the physiography and general regional geography of the Southern United States, will find much interesting material to fit into his regional scheme. In general he will not find this done for him, though to fulfil just this function would seem to have been the major intention of the author, as implied in his title and in the arrangement of his book.

The obviously wide reading displayed in the host of quotations from standard and lesser known works on social and economic conditions help to make the book one of real significance to the geographer; yet somehow it just fails to be geography. The one peculiar and legitimate function of the geographer lies in the establishment of correlations between physical circumstance and human activities. This function is often clearly in the mind of the author, but something —perhaps lack of space, or too intense a preoccupation with social and economic matters *per se*, or again too great a proximity to the card index—something, at any rate, has prevented the elaboration of his work on strictly geographical lines.

The plan of the work is logical and simple. The opening chapters deal with the concept of regionalism, and with a summary description of some of the major physiographic regions. Then follows the incidence of certain subjects which altogether transcend the region; such, for example, as the legacy of slavery, the

cotton economy (particularly well done, this), and the relations of climate, disease, and dietary to Southern inefficiency. At long last comes the final sixteenth of the book, with its somewhat vague suggestions for a planned economy on a regional basis.

The logical intention is thus clear enough; but the thread of the argument becomes frayed in the working out. The book is too much a mere patchwork of collected material. It is incompletely organized. For example, in the chapter entitled "The Concept of the Region," the writer refers, quite uncritically, to some half a dozen different systems of regional classification, and in the sequence uses no one of them, nor indeed, any at all.

The section called "The South's Profile" proves to be an entirely inadequate account of some of the generally accepted physiographic divisions, in no way illuminated by a half-hearted application of Geddes's valley section. Geddes, one supposes, was in the card index, and had to be dragged in somehow. There follows a chapter on soils in which the well-known major divisions of the American Atlas of Agriculture are reproduced *en bloc*, and with little elucidation, and not, as they so well might have been, related to the economic development of the major regions.

For the present writer the interest of the book began with the chapter headed "The Piney Woods" (p. 109), and was maintained, for the most part, to the end of the work (p. 511), although a disproportionate amount of space seems to be allotted to the question of how far the relatively backward development of the South is rooted in physical conditions. The author makes his point, that with modern technique—of medicine, transport, and agriculture—the permissive environment of the South is perhaps as favourable as that of the North. Yet this was not always so. Development has suffered a time lag, and the reasons for this are most definitely geographical. In terms of Historical Geography, the North-East had quite definite advantages, particularly in a greater accessibility to the Great Appalachian valley, to the Ohio, to the Pennsylvanian coalfield, and to the Great Lakes. These large-scale factors gave to the North the priority of economic development. Coming so long before the possibility of that amelioration to which allusion has been made, this earlier development condemned the South to a dependent economic position.

We can recommend this book to the students of American Geography. For them, especially, the emphasis on economic and political factors will prove a healthy corrective to the usual presentation of the typical geography text-book. There is a very full bibliography, and an adequate index. LL. R. J.

NORTH AMERICA, including Central America and the West Indies. By EDWARD V. LANE. (Harrap's New Geographical Series. General Editor: R. N. RUDMOSE BROWN.) *London: George G. Harrap & Co.* 1933. 7½×5 *inches; 366 pages; illustrations and maps.* 3*s* 6*d*

This is a school text-book and quite a satisfactory example of its kind. There is a judicious selection of material, good arrangement, and a number of significant illustrations. A welcome innovation is a short chapter on the making of the United States; but it is unfortunate that, the subject being introduced, the treatment of it should be so little geographical.

In the main the book is accurate, but occasionally, possibly because of severe condensation, the treatment seems to convey a wrong impression. On p. 159, for example, the wording seems to suggest that the Atlantic coast cities receive petroleum supplies by pipe-line rather than by tanker; which is not so. The south-eastern pine-belt is neither indicated in the vegetation map nor does it receive specific mention in the text. The great southern cotton manufacturing

industry is referred to only in the section dealing with New England. Considering the elementary standard of the book however these are not very important points.

The present reviewer cannot help regretting that the authors of elementary text-books should continue the attempt to crowd into necessarily small volumes the facts proper to a reference notebook, as well as the descriptive matter, argument, and elucidation of principles, which alone are likely to stimulate interest. This is a more successful essay than most, and in so far as it lacks interest, it does so simply because the author is attempting the impossible.

LL. R. J.

CENTRAL AND SOUTH AMERICA

SOUTH AMERICA: a continent of contrasts. By KASIMIR EDSCHMID. Translated from the German by OAKLEY WILLIAMS. *London: Thornton Butterworth* 1932. 9½×6 *inches; 408 pages; illustrations and map.* 21*s*

Since travel has become easy and rapid, the book of travel has tended to become sketchy and superficial, too often resembling an expanded newspaper article. This applies particularly to most of the books on South American travel that have been published of recent years. Too often the author has been concerned with South America either as a visionary economic "land of promise," or as a continent of glamour and romance existing largely in his own imagination. Mr. Edschmid does neither of these things. He has returned to the tradition of Darwin and Wallace, and written a book of travel in South America that is full of careful observation and detailed description, which as a result is as fascinating to read as the 'Voyage of the Beagle.'

The book is written in the form of a narrative of the wanderings of one Goehrs, a German, round the coasts of South America, from Venezuela, by Panama and the West Coast countries, to Argentina and Brazil. Throughout he follows the ordinary route of the tourist, and seldom leaves the railway for more than a few miles, but in spite of this the book is more absorbingly interesting than many books of adventure. Goehrs has the true spirit of the traveller, interested in every aspect of the life of the countries he visits, and he records his observations with a refreshing absence of comment and careful attention to detail. Whether concerned with the floating islands of vegetation of the Guayas river, the hard bright landscape of the high Andes, or the level green Argentine pampas, his descriptions of scenery are carefully observed, accurate in detail, and yet vivid. Still better are his accounts of the life of the people, with well-chosen, well-described illustrative incidents, and admirably reconstructed conversations. It is impossible to do justice to the wealth and variety of information that this book provides, but scarcely any of it is irrelevant, and none of it is boring.

The chief interest of the book lies in its illuminating comments on present-day social and political problems in South America. As a German, Goehrs shows a deep interest in the present position of Germany and Germans in the South American countries. "It appealed to him to have found a continent, after the many countries he had visited, where for the first time after the war Germany counted for something." There is much information on the important part played by Germans in the development and settlement of South America that will be new to English readers.

Equally, Goehrs is concerned with the rising importance of the United States in South America, and her gradual but thorough economic penetration, particularly of the West Coast countries. The reactions of South Americans to this penetration are well described, though the picture he draws, in scattered but telling strokes, of the future of South America is a rather depressing one.

Although he seems to visualize the continent some decades hence as "virtually a Yankee colony," yet he devotes much attention to the possibilities of the mixed race now evolving, on its own lines, its peculiar culture. His analysis of the attitude of the Brazilians to racial admixture between negroes and whites, in contrast to that of the North Americans or South Africans, is one of the most interesting parts of this unusually interesting book. He has much to say, too, on the present position of the Indians in the Andean countries, and valuable comments on the methods of republican government, as illustrated by the South American states.

The chief fault of the book is its style. The clipped, verbless phrases that in places mar Mr. Edschmid's descriptions may be perhaps a reaction from cumbrous German phraseology, but they irritate the English reader. As a whole however the book is well written, and the translation has retained the vividness of the original. It is unfortunate that place-names are sometimes mis-spelled, while the illustrations entirely fail to do justice to one of the best books on South America that has appeared for many years. M. S. W.

MEXICO BEFORE CORTES. By J. Eric Thompson. *New York; London: Charles Scribner's Sons* 1933. 8 × 5½ *inches;* x+298 *pages; illustrations.* 10s 6d

The still supreme text-book on this subject is Joyce's 'Mexican Archaeology,' now out of print, "but," writes Mr. Eric Thompson, of the Chicago Museum, "for the benefit of those who have had the fortune of reading or possessing a copy, I have tried to make this book" ('Mexico before Cortes') "to a certain extent complementary to his. This has been achieved by outlining in detail certain ethnological customs to which he paid little attention, and, on the other hand, stressing little the archaeological aspects fully developed in his book. Naturally a considerable amount of duplication cannot be avoided. . . ." That states the case with generous candour. And all who are capable of feeling the strange excitement of Mexican art or the gloomy beauty of Mexican civilization will welcome this volume. Here are no fancy theories of colonization from Atlantis or Egypt, with elephants imported from Asia, but apt quotations from sixteenth and seventeenth century men like Diaz, Torquemada, and Gomara, who were on the spot. The author's investigations of peasant rites yet surviving are invaluable apart from anything else. It is true that he uses the verb to *debunker*, and that on the very first page of Chapter I he gives the reviewer an anxious moment by stating that "man did not originate in the New World. There are no anthropoid apes on this continent from which he could have developed." There is a slip on p. 80: the Mexican cloak was worn not "round the shoulders and tied by knotting together two of the corners on the chest or under one arm," but over one shoulder, as Mexican paintings and sculptures show quite clearly. Several references to plates are wrong.

Mr. Thompson is never florid. Indeed he is almost too reticent about his heroes. He might have insisted that the idea of their being bloodily sacrificed in the heyday of their youth, in order that the youth of the life-giving gods should be renewed, was not frightful even to the victims themselves, but noble and magnificent. K. H.

YAMANA—ENGLISH: a dictionary of the speech of Tierra del Fuego. By the Reverend Thomas Bridges. Edited by Ferdinand Hestermann and Martin Gusinde. *Mödling (Austria): Printed for private circulation only (by Missionsdruckerei St. Gabriel)* 1933. 9½ × 6½ *inches;* xxiv+664 *pages*

It must be accounted extremely fortunate that this dictionary has at last appeared in print. As Colonel Furlong remarks in his paper in the March *Journal*, "the

history of its peregrinations is a story in itself." The Rev. Thomas Bridges, a pioneer in Tierra del Fuego, and undisputed authority on Yamana, the language of the Yahgan tribes, died in 1898, leaving this dictionary in manuscript. His family now publish it as the most fitting memorial to his life-work. Drs. Hestermann and Gusinde have transliterated it in accord with a modern scientific system, and Mr. W. S. Barclay contributes a short preface on the author's life, and on the Yahgan environment.

At the time of Darwin's visit there were perhaps three thousand Yahgans—now it is doubtful if they are more than sixty. Their language, here rescued from oblivion, is astonishingly rich in words, and intricate in structure. It possesses, for example, sixty-one terms expressive of kinship, compared with the twenty-five in English. The value of this work to students of ethnology and linguistics is obvious, and all concerned in its production are to be congratulated. G. R. C.

AUSTRALASIA AND PACIFIC

THE FIFTH CONTINENT. By E. O. Hoppé. *London: Simpkin Marshall* [1932]. 11 × 9 *inches;* xxxii (*text*) + 160 (*illustrations*). 7*s* 6*d*

WE FIND AUSTRALIA. By Charles H. Holmes. *London: Hutchinson & Co.* 1933. 9 × 5½ *inches; 254 pages; illustrations and sketch-map.* 12*s* 6*d*

Mr. Hoppé's picture-book is an uncommonly beautiful production. The author stayed in Australia for ten months, photographing every important phase of life and scene, and although this volume of reproductions contains no more than the pick of his material, it must be one of the most representative collections of Australian views ever assembled. Notice the skill of his use of dead timber in the foreground (pp. 16, 24, 36) and his appreciation of what hard light does to Gothic architecture (pp. 1, 138). These pictures adequately represent the quality and the variety of the Australian scene, and they reflect Mr. Hoppé's delight in Australian life. They show little sign of "trick" photography, but the level skyline of the Blue Mountains has been given a disastrous tilt on p. 26. Part of the author's purpose is to induce travellers to go to Australia, and in his thirty-two pages of text he offers them further inducement. The best lines are those in praise of angling, but the text has not the quality of the pictures. Apart from the minor inaccuracies of a traveller, it betrays a misconception of the hydrology of Australia, and contains a passage on shooting, which, considering the difficulties of protecting a unique fauna, is to be regretted.

Mr. Holmes, and his companion the camera man, made a trip that enabled them to see nearly everything, and, as they made it at the right time, they saw everything at its best. Mr. Holmes is an enthusiast, and the camera man's pictures are excellent, so that the book is a success. Though not well written, its eager straightforwardness makes it very good and reliable reading. They went clockwise around Australia, by train, 'plane, boat, car, and camel, with a long excursion from Newcastle Waters into the Macdonnell Ranges, and several shorter excursions, notably those out to the Great Barrier Reef. They encountered a wide variety of conditions and of ways of life. The most valuable parts of the book are the chapters on the torrid north, where the conditions of white settlement are still those of pioneering life. White Australia does not exist in fact north of the 20th parallel. Townsville, Cairns, the Atherton Plateau, and Cloncurry are "white," and are on or within the 20th parallel, but the region, that of the cassowary and the tree-kangaroo in eastern Queensland, lies within other shadows from the north and is the asylum of the aborigines. Together, these books show, by implication, that the protection of the aborigines, the fauna,

and the flora are still, unfortunately, of minority concern in Australia. The original Australia, so changed and subdued in the settled country, has now to be sought in the bush and the Never-Never. Mr. Holmes says that in the Macdonnell Ranges he "could feel the force of an ancient continent," a most uncommon feeling for an Australian, but one curiously in accord with the sense of "hoary antiquity" which affected, and even oppressed, D. H. Lawrence in the bush.

M. A.

POLAR REGIONS

PRAIRIE TRAILS AND ARCTIC BY-WAYS. By Captain HENRY TOKE MUNN. *London: Hurst and Blackett* 1932. 9×5½ *inches;* 288 *pages; illustrations.* 12*s* 6*d*

Mr. Munn is what the North Canadians call a "good musher." The spin of a coin sent him to Canada in 1886 and the fascination of a rapidly developing country kept him there and in Baffin Land, hunting, prospecting, and trading, until he retired to England for good. The book is pleasantly written, is packed with stories, and throws some interesting sidelights on the gold rush of '98 and the different modes of life of Indians and Eskimos. It is a straightforward set of reminiscences without pretentions at either scientific value or subtle description; but the author has managed to include in it something of the fatalism of the North that accepts food or famine as the natural alternatives in the cycle of events and resigns itself peacefully to its fate when death is inevitable. J. M. S.

PHYSICAL AND BIOLOGICAL GEOGRAPHY

THROUGH WONDERLANDS OF THE UNIVERSE. By R. H. GOLIKERE. *Bombay: D. B. Taraporevala Sons & Co.* 1933. 8½×5½ *inches;* xviii+400 *pages; illustration.* 6 *rupees* 4 *annas*

The chief aim of this book, says the preface, is to convey concisely and as simply as possible an idea of the principal features of the various divisions of the material universe. The author has read extensively, in some of the best authorities, and much of his information is clearly arranged. But he has a curious way of looking at things from the point of view of the "record hunter." His chapters are built upon numbered headlines in large type: thus in the chapter on the Land Surface and Lower Troposphere we have (21) World's Tallest Building—The Empire State Building, New York, 1252 feet with 102 stories. A long note compares this with other high structures, including the Great Pyramid with 34 stories and Cologne Cathedral with 40. Paragraph (22) gives us the average elevation of North America, 1350 feet; (23) of the Earth's entire Land Surface, 1440 feet; both these without comment. Then (24) Elevation of the World's Deepest Lake —Lake Baikal, Siberia, 1516 feet; and half a page about Lake Baikal. There appears, then, some discontinuity of treatment, until one realizes that the paragraphs are deliberately arranged according to height above sea, and (77), Greatest Height at which insects have been caught—13,200 feet, is followed by (78) Elevation beyond which trees cease to grow—13,457 feet.

A chapter on the Giant Peaks of Asia is more naturally arranged on this plan. Kamet comes in at 25,447 feet, two more than Namcha Batwa, but with the note: " N.B.—Almost all the books which we have consulted give the height of this peak as 25,431 feet, but the figure we have given here is taken from the cabled report of the conquest of the peak by Smythe and other members of his party." The author is apt to be uncritical of his authorities. He quotes Jeans and Jeffreys and the *Popular Mechanics Magazine* with equal confidence, and assures us that

the water in waterspouts "has always been found to be fresh" on the word of a writer in the *Star*. A fantastic chapter on Rocket Science is based on an article in the *Illustrated Weekly of India*, written by a lady who had interviewed a famous rocket expert in Germany. It comes oddly in a book which aims at being a serious guide to the intelligent layman, and does contain much sound information.

DIE GROSSPROBLEME DER GEOLOGIE. By J. KALJUVEE. *Tallinn (Reval): F. Wassermann* 1933. $10\frac{1}{2} \times 7\frac{1}{2}$ *inches;* viii+162 *pages; illustrations and maps. M.*7.50

Those who have read Dr. L. J. Spencer's paper in the March number of the *Geographical Journal* will agree that meteorites may have had a greater effect upon the Earth than has been generally supposed; but few will go so far as the author of this book. He belongs to the catastrophic school of geology, which became almost extinct last century, but has revived since the war. His catastrophes are due to the impact of cosmic bodies of a size undreamed of by Dr. Spencer; otherwise he is a disciple of Wegener, to whom he dedicates his book. The gigantic meteorites imagined by the author break up the sial sheet and separate the fragments, cause transgressions of the sea and movements of the pole, and raise mountain chains. They solve, in fact, the chief difficulties that Wegener leaves unexplained.

In detail the author does not always agree with Wegener. Before the Pliocene catastrophe Spain lay between Ireland and Nova Scotia, and the east coast of Greenland lay against the west coast of Scandinavia. But such differences are of minor importance. It may be noted that he assigns a Pliocene date to the lava-flows of North-East Ireland and the Hebrides, and also to the Deccan Trap of India, but this does not affect the general theory. Floating continents and meteorites to direct their movements can explain anything. P. L.

EARTH-LORE: geology without jargon. By S. J. SHAND. *London: Thomas Murby & Co.* 1933. 8×5 *inches;* viii+134 *pages; illustrations and sketch-maps. 5s*

It is far from easy to write on any technical subject without using terms which are not in the vocabulary of the "man-in-the-street." Professor Shand has set himself a difficult task, and has accomplished it with considerable success. In about 130 pages he has reviewed many interesting features of the Earth's surface, and has given a short, but concise, account of many geological processes. He has by no means restricted himself to the surface of the Earth: in fact, he has made a particular point of indicating something of what is surmised about its interior.

The lay reader of the book should find much to interest him. It is probably impossible not to give such a reader too simple an idea of difficult and little-understood points, and in this respect one may certainly criticize the book. But the more important point is, presumably, to engage the reader's attention, and this Professor Shand has accomplished. He will possibly leave the reader somewhat prejudiced in favour of drifting continents, though he has pointed out some of the major objections to such theories. He might at the same time have shown that South America does *not* comfortably fit into the west coast of Africa: certain points in the book appear to be based on the assumption that it does. The figures are usually clear and helpful: the one showing the paths of earthquake waves would not have been much more complicated if these paths had been shown as curved towards the centre of the Earth instead of straight—and it would certainly have been nearer the truth.

The book however is not intended for the expert, and consequently detailed criticism is hardly justified. J. A. S.

ECONOMIC AND HISTORICAL GEOGRAPHY

PRIMITIVE ARTS AND CRAFTS: an introduction to the study of material culture. By R. U. Sayce. *Cambridge: University Press* 1933. $7\frac{1}{2} \times 5$ *inches;* xiv+292 *pages; illustrations.* 8*s* 6*d*

The handiwork of primitive man being closely associated with his social and religious life, the author of this work submits that the study of the material side is a good method of approach to an understanding of other aspects of culture. With this object in view he treats of the discovery or invention of human artifacts, their variation, spread, survival, and decay. Accordingly attention is directed to three main points: Invention and Discovery, Diffusion of Culture, and Migration, its most potent cause.

The causes of diffusion of culture are many and varied. Of geographical barriers to diffusion, climate is not the least important. A striking example is the climate of the regions round Bering Strait, so often regarded as the great diffusion bridge between Asia and America. In these regions agriculture is impossible, and therefore the acts associated with it could not have reached America by this route. The spread of tobacco is taken as an example of diffusion, and the route by which it travelled is in some cases very curious; for example, it reached the Eskimo from the Plain Indians, not by travelling north on the same continent, but by travelling round the world. Carried to Europe and Asia it passed to the Eskimo from the north-east of the latter continent: the Eskimo pipe is distinctly Asiatic. The influence of Migration on Diffusion can hardly be exaggerated. "All migratory movements," says Baron Nordenskiold, to whose valuable ethnological studies Mr. Sayce is much indebted for many facts and illustrations, "are productive of inventions, or loans of new cultural elements, and modifications of old ones."

The question, so keenly debated in recent years, whether an invention can be made independently in more than one place could hardly be avoided by the author who refers to it in his last chapter. The controversy has not unnaturally concentrated on America, for it offers an extreme case of either independent origin or diffusion. The developed agriculture of Central and South America could not have been diffused by way of Bering Strait for climatic reasons, therefore if derived from the Old World its route must have been by the Pacific. The extreme diffusionist school has not hesitated to carry its so-called Heliolithic culture complex, originating in Egypt, not only across Asia, but also across the Pacific to the New World. It is no doubt possible that a Chinese junk, or a Pacific island canoe, being blown out of its course, may have reached the American coast, but that they carried migrants in sufficient numbers, or in a position, to introduce their culture is a different matter. It is significant that some Old World plants and animals well known to the Pacific islanders, and with which they provided themselves on their voyages, were absent from America; on the other hand there were many cultivated plants, with various methods of cultivation and use, peculiar to the New World. The cultivation of a new plant may well require as much originality as the invention of a new implement or process, and if so there seems no reason why the American native should not be capable in his own domain of inventions known in the Old World. It is a question whether pottery was independently discovered in America. Nordenskiold ingeniously suggested that its germ may have arisen from the clay ball used by the Indians for boiling, and he was convinced, as the result of his extensive and unrivalled investigations, that bronze was an independent invention in America, where it was preceded by a Copper Age.

Although the author modestly speaks of his little book he has as a matter of

fact covered a considerable field of research. His style is at times somewhat discursive, but this does not make his book less interesting to read, and the unbiassed, scientific attitude maintained throughout should not fail to attract the reader to an important aspect of Anthropology. E. A. P.

AN ECONOMIC GEOGRAPHY OF THE BRITISH EMPIRE OVERSEAS. By J. INNES STEWART. *London: Sir Isaac Pitman & Sons* 1933. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* x+232 *pages; maps and diagrams.* 6*s*

The writing of an elementary text-book of economic geography is not a simple task. The broadest generalizations are necessary, but an author must himself understand first the principles involved. In this case he clearly does not, and has fallen into many pitfalls; indeed it is difficult to find a page on which there is not an error of simple fact. The book is professedly written for candidates preparing for the General School Examination and various professional examinations; but many a candidate has failed in those very examinations for errors less serious than those which the author of this book commits. Even when the major climatic regions of the world are considered in only seven pages, it is not permissible to include the Hungarian Plain and Rumania in the Mediterranean regions, nor have Central France, Central Germany, and Czechoslovakia a temperate grassland climate to be included in the same region as the steppes of southern Russia or the Canadian Rockies. Some errors are immediately apparent, as when the Irrawaddy delta in Burma is credited with producing apples; but the majority are more dangerous in that they contain an element of truth, as when the equatorial type of climate is stated to occur in Central America and the West Indies, or when oil is stated to come from *the* Californian field, or when teak is shown as a product of the *heart* of the Indian plateau.

L. D. S.

GENERAL

TOLD AT THE EXPLORERS' CLUB: True Tales of Modern Exploration. Edited by FREDERICK A. BLOSSOM. *London: George G. Harrap & Co.* 1932. $9 \times 5\frac{1}{2}$ *inches;* 390 *pages; illustrations.* 10*s* 6*d*

Anthologies of modern adventure are becoming rather the fashion; perhaps it is because the reading public lack the money and the time to acquire whole books upon each subject. This one contains thirty-three stories by different authors who are not necessarily connected by any other bond than that all have travelled and all have had adventures of one kind or another. Such variety in construction precludes the achievement of an epic character which is essential to a first-class book of travel. One author is terse and to the point: "The night was dark and the anchor wouldn't hold, so we went ashore." Another is more stylistically ambitious: "At Tiahuanaco is an ancient Spanish church which displays, built into its sturdy walls, the anomalous vandalism of great blocks of pre-Inca stones, carved with symbols of a lost sun-worship." The result is a patchwork of geographical experiences in which one may find interest as well as amusement.

J. M. S.

HALF THE SEAS OVER. By CLIFFORD W. COLLINSON. *London: Hutchinson & Co.* 1933. $9 \times 5\frac{1}{2}$ *inches;* 288 *pages; illustrations and sketch-maps.* 18*s*

In this amusing book of travel the author describes his journey from England to Australia, by way of Canada, Japan, China, and the Philippine Islands. Although too much space is given to recounting anecdotes and incidents on the voyage, the book contains much interesting matter.

In Canada, visits to a lumber camp and a prairie farmstead are described, followed by a trip to Alaska and a discussion of the salmon-fishing industries on the coast of British Columbia. The superabundance of fish in this latter region is emphasized by the author's difficulty in disposing of eight salmon averaging over 9 lb. apiece, and the final solution of the problem by their removal for manure! In Japan, reached by way of San Francisco and Honolulu, the author is able to give descriptions of native life, not as seen by the average traveller, but from a more unconventional viewpoint. Between Hong Kong and Sydney, at which port the voyage was terminated, the journey was broken for brief intervals at Manila and at Thursday Island.

The whole is written in a humorous manner for popular consumption; and one occasionally wonders whether some "corroborative detail" has not been added to some of the general descriptions: would the midnight sun be visible in mid-October off the southern coast of Alaska? G. W.

THE *CUTTY SARK*. By C. N. LONGRIDGE. Two volumes. *London: Percival Marshall & Co.* 1933. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* Vol. I, xxx + 208 *pages;* Vol. II, xii + 232 *pages; illustrations and plans. 7s 6d each*

No one who reads Dr. Longridge's description of the building of this model can fail to admire the skilled amateur craftsmanship apparent at every stage of the work. His book is devoted to the *Cutty Sark* model, from the roughing out of the hull to the polishing of the binnacle; but the clear description throughout and the many hints for executing detail work on a scale of 60 : 1 make it almost a ship-modeller's text-book. Examples of the minute accuracy of the work may be found in built-up gratings of boxwood and satin walnut stringing $\frac{1}{32}$ inch square; metal stropped dead-eyes $\frac{3}{32}$ inch in diameter; and a sand-glass $\frac{1}{8}$ inch high! Dr. Longridge, with commendable candour, makes no claim to being a seaman, and therefore disarms criticism of his occasional misuse of technical terms. But, where so many are used, it seems a pity that the lifeboat's thwarts should be called merely *seats*.

The first volume is devoted entirely to the hull, and to those more interested in the actual ship than in the model, is a little disappointing. There is little about the composite construction of the real vessel, as the book is almost entirely concerned with her model, built on the "bread-and-butter" system, with dummy planking laid on and copper sheathing to scale. Volume II however, devoted to the spars and rigging, atones for this by describing most carefully the rigging of the ship herself, with numerous photographs, and one has less of the feeling that there is too much model and too little ship. There is moreover printed in the second volume the original specification for the building of the *Cutty Sark* kindly supplied by Captain and Mrs. Dowman, her present owners, which is a most valuable and instructive document. The book is fully illustrated with drawings and photographs, and its value is enhanced by the four clearly drawn supplemental plans by Mr. Harold A. Underhill and by Dr. Longridge's own diagrammatic layout of the bulwarks, showing where the various halliards, etc., are belayed. A word of praise should be added to the publishers for the clear print and admirably reproduced illustrations. The author is to be thanked for a book which will be welcomed alike by the model maker and by the student of the clipper ship. F. G. G. C.

THE MONTHLY RECORD

RETIREMENT OF MR. REEVES

On June 30 Mr. E. A. Reeves retired on pension from the offices of Map Curator and Instructor in Survey, after fifty-five years in the service of the Society. His friends in all parts of the world who have received instruction from him will join with his friends and colleagues at home in wishing him renewed health and fruitful leisure in his retirement. Having joined the Society's staff as a junior in the Map Room in 1878 he set himself to learn the arts of survey and field astronomy, under the guidance of Mr. John Coles, whom he succeeded as Map Curator in 1900 and Instructor in 1902. Being a man of great natural talent, resolution, and energy he had worked unceasingly to master and then to improve the instruments and processes best adapted to the use of the skilled traveller, and with such success that many of his pupils obtained appointments in the surveys of the Crown Colonies and many of our most distinguished Gold Medallists have acknowledged their debt to his instruction and advice. His tangent micrometer, intermediate between the old vernier and the modern micrometer microscope, had a success in its time. His Prismatic Astrolabe Attachment to the theodolite ingeniously combines the great merits of the astrolabe with the universality of the theodolite and makes the best equipment for a traveller with high ambitions but restricted transport. His diagram for the graphical solution of spherical triangles, adapted to the computation of bearing and distance of Time Signal stations (R.G.S. Technical Series No. 5), is a good example of his practical talent. But his enduring monument is the first volume of 'Hints to Travellers.' He made this volume in the ninth edition of 1906 the most useful and comprehensive treatise of its kind. It was improved in the tenth edition of 1921; and his last great service to the Society has been the largely rewritten first volume of the eleventh edition now in the press.

While his work as Instructor in Survey has been the most conspicuous of his threefold activities, and has seemed to occupy a large part of his time, he has never relaxed in his attention to the duties of the Map Curatorship and control of the Drawing Office. He has an unrivalled knowledge of the state of mapping in every part of the world, the contribution which every expedition of the last fifty years has made to it, and the precise value of that contribution. Sixty volumes of the *Journal* are filled with maps drawn under his direction, of which many owe much of their value to his compilation and computation. An outstanding example of his draughtsmanship is the Map of the Caucasus drawn to illustrate Mr. Douglas Freshfield's journeys: the original hangs in the Instruction Room as an example to us.

A serious illness at Easter has deprived us of his services during the last months of his long duty, and he has been on leave pending retirement, so that many of his friends who had hoped to take an affectionate farewell have been disappointed. His colleagues on the staff have thus a little earlier than they had expected been able to realize how great a gap is left in the working strength of the Society.

PROPOSED NATIONAL PARK IN THE RHONE DELTA

The wide, slightly elevated, and in part swampy, tract known as the Camargue, which occupies the greater part of the Rhone delta, is one of the few areas in France still left in a nearly primitive state. Without special scenic beauty, it possesses a peculiar attraction from its comparative solitude and almost boundless horizons, which have been well described by Alphonse Daudet; and it forms a

sanctuary for many rare forms of plant and animal life which have found here a last asylum. A limited area has already been set apart as a zoological and botanical reserve. But the tract has caught the eye of the utilitarian, who is loth that so large an area should remain more or less unproductive, and many schemes have been put forward for its reclamation. A strong conflict of opinion has resulted and counter proposals have been made that the whole or the greater part should be proclaimed a national park. The subject is fully dealt with in an article by Mm. P. George and C. Hugnes, in the first number of the *Etudes Rhodaniennes* for 1933. Besides describing the tract in its present state, their study traces the vicissitudes to which it has been subject in the past, and discusses the projects for its reclamation. As is known, the Camargue has not always been the solitude which it forms now, for abundant ruins testify to the activity displayed here in the early centuries of our era. The authors refer to Mr. R. D. Oldham's historico-geographical studies, and his view that the change has been brought about by a general sinking of the ground. They express some doubts as to the correctness of this view, thinking it possible that the extension of the swampy areas may be due to the absence of free drainage caused by the blocking of the river's old outlets, and that with suitable measures the fevers bred of the swamps might be once more banished. During the past century something has been done in this direction, and the tract even now is by no means valueless. It was always a field for stock-raising, and the breeds have been gradually improved, while agriculture and vine-growing have made some headway. The natural fauna and flora are described in some detail, the former including the beaver, and above all an extraordinary variety of bird-life, aquatic or semi-aquatic species (including the flamingo) naturally predominating. It is pointed out that, given the exploitation of the delta on modern lines, the 10,000 hectares allotted to the reserve would be quite insufficient to secure the space and quiet needed for the preservation of this part of the fauna. It is not only the lovers of wild nature who are opposed to the new grandiose projects, for objections are also raised on the score of the vast expense involved, while the danger of over-production is urged by the vine-growers of Languedoc. The present pastoral inhabitants naturally view any further encroachment of agriculture with disfavour. There seems a chance that the Act of 1930 for the protection of natural monuments may be successfully invoked to save the Camargue from industrial invasion.

RIVER SYSTEM OF BELGIUM

In a paper entitled "Morphologie, tectonique et érosion," published in *Rev. Quest. Sci.*, March 1933, Mons. Ch. Stevens discusses in some detail the evolution of the Belgian river valleys. It has hitherto been supposed that, with the exception of the great Sambre–Meuse trough and the valleys of the Haine and Vesdre, the drainage lines of the country were determined entirely by erosion and not by earth-movements of folding and fracturing. The fact however that Belgium is surrounded by regions where tectonic factors have given to the hydrographic systems their essential features led the author to suspect that the tectonic origin of the Belgian valleys might be masked by abnormal trend and thickness of the geological deposits. The result of the geological investigation is to show the correctness of this surmise. In Belgium erosion has confined its effect to developing the relief initiated by tectonic movements and to carving out secondary valleys in each main valley. The two chief structural units of the country are the uplift of the Ardennes and the anticline of Brabant separated by the cleft of the Sambre–Meuse. These have determined the courses of the Meuse and Scheld, but it is found that numerous tributaries correspond with the trend of transverse minor folds. Thus the Fraipont anticline and Limbourg uplift governed the hydro

graphy of the north bank of the Démer, and the separation of the basin of the Haine from that of the Sambre–Meuse was conditioned by the Beaumont uplift and Anderlues plateau. Similarly the valley trend of the Meuse in the neighbourhood of Dinant probably originated in a transverse syncline.

RAINFALL OF ERITREA

In a pamphlet entitled 'Le Precipitazioni Acquee nell' Eritrea dal 1923 al 1931,' from *Giornale del Genio Civile*, fascicolo 8, 1932, Professor Filippo Eredia gives a more detailed account of the rainfall of the country than has hitherto been available. Climatically the country falls into a number of well-marked zones running north and south. These are (1) a coastal strip with sparse irregular winter rainfall and none during the intensely hot summer; (2) a low eastern plain with more abundant and regular rainfall chiefly in winter; (3) the steep eastern slopes of the high plateau where there is a heavy winter rainfall and occasional violent summer storms; (4) the high plateau, about 7000 feet, with a regular summer rainfall; (5) the gentle western slopes of the plateau also with regular summer rains; (6) a low western plain having a smaller summer rainfall; (7) a desert zone, passing into the Sudan, climatically analogous to the coastal strip except that the sparse rains come in summer instead of winter. The wettest zone is No. 3, where a few places receive about 50 inches of rain a year. The driest station in a list of thirty-one is Massaua, on the coast, where the annual rainfall is only 6 inches. The small number of days on which the rain falls emphasizes the generally droughty character of a climate where the mean day and night temperature in the hot months varies from about 90° F. on the Red Sea coast to 70° F. at 7000 feet. At Massaua the average number of days with rain is only 23, and even at Gondar, the wettest station, no greater than 106.

THE CHINESE FLOOD OF 1931

A valuable economic survey of the results of the Chinese floods of 1931 has been published by the College of Agriculture and Forestry of the University of Nanking. (The distributors for Great Britain are the Cambridge University Press.) The map accompanying the bulletin shows the areas affected in the lower valley of the Yangtze and the basin of the Hwai. The whole of the lands along the lower Yangtze below Ichang suffered: the four areas of greatest damage comprise the valley from Wuhu to Tungliu, a large area south of Poyang lake, the area of scattered lakes north of the bend above Hankow, and the area north of Changsha to Tung-ting lake. In the Hwai valley there was an extensive flooded area east of Kaoyu lake and the Grand Canal, and a wide district north of the river from Ying-shang downstream, which extended as far north as Yung-cheng. In estimating the extent and degree of flooding, reports from 90 different *hsien* and from over 11,000 farm families have been utilized, in conjunction with air surveys.

The cause of the floods was not difficult to determine. In July 1931, when the Yangtze is normally high, an unusually large number of cyclones passed over the lower Yangtze valley. Four stations reported rainfall for the month of over 24 inches, and four more falls exceeding 20 inches—that is, over half the mean annual precipitation was received in one month. The average mean depth of water over the area was 9 feet, rising to 11½ feet for Hunan, and houses were uninhabitable on the average for 51 days.

The number of people affected approached 25 million, a figure equal to the entire agricultural population of the United States. The chief damage suffered was the loss of summer crops, accounting for 47 per cent. of the total loss: the value of buildings destroyed accounted for 24 per cent. In Hunan the water remained until it was too late to get in a wheat crop, and in Kiangsi it was too late

for a second rice crop. East of the Grand Canal no winter crops could be planted. The province of Anhwei suffered 29 per cent. of the total loss, closely followed by Hupeh, with 27 per cent. The loss of life through drowning, 25 per cent. of the total, approached 150,000; and disease accounted for 70 per cent. A further result was to increase rates of interest in the flooded area by one-third, and to decrease land values also by one-third. As to the future, engineering opinion is agreed that conservancy works alone cannot prevent the occurrence of such catastrophes: it may prove more economical to permit farm land to be flooded in abnormal years, rather than to embark upon costly plans of dyking. Much can be done by building mounds and foundations of brick or stone for the farm-houses, and by providing a form of flood insurance. A system of regular crop reporting, organized by the Government, would permit an estimate to be formed of the extent and seriousness of future calamities.

THE FLORA OF MOUNT ELGON

That a considerable amount of scattered information about the flora of Mount Elgon exists is shown by the list of twenty-four authorities given by Major E. J. Lugard in a paper on this subject in the Kew Gardens *Bulletin of Miscellaneous Information*, No. 2, 1933. But Major Lugard, with his son, Captain Cyril Lugard, who has a coffee farm on a spur of the mountain, collected 649 species, of which at least 36 are new or have not previously been described. The mountain, on the border of Kenya and Uganda, described as the largest extinct volcano in the world, measuring 150 miles round the base and 8 miles across the crater, unlike Kenya, Kilimanjaro, and Ruwenzori, holds no permanent snow, although a number of old moraines show that it was glaciated in the pluvial period. Major Lugard refers to the trying climatic conditions experienced during the ascent of Mount Elgon, a cutting wind rendering it too cold to rest in the shade, and the fierce equatorial sun equally prohibiting rest in the open. He recognizes three distinct zones of vegetation merging into one another and varying much in altitude according to aspect. These are: (1) the Sub-montane zone, between 6000 and 7500 feet, containing grass with scattered trees—mainly acacias, heavy forest along the banks of streams, as well as much cultivation ; (2) the Mountain Forest zone, between 7500 and 10,000 feet, characterized by grass and bamboo forest with common bracken ; (3) the Alpine zone, between 10,000 and 14,000 feet, the region of "mountain meadows" where occur giant forms of many plants which in most countries only attain a low growth, such as tree-groundsels, tree heaths, and giant lobelias.

The bamboo forest of this and other of the Equatorial mountains of East Africa is remarkable in consisting of only one species, although numerous other species grow all over the world in tropical or sub-tropical regions. The lower zone contains the most beautiful and gorgeously coloured flowers, the more interesting for the variations of colour which some of them exhibit with altitude. Thus the scarlet gladiolus varies greatly in colour between 6000 and 11,000 feet, and the tall blue-green delphinium becomes bluer as the altitude increases between much the same limits.

The flora of Mount Elgon is fairly typical of the other high mountains in this part of Africa, but it is pointed out that the vegetation on the lower western slopes where the rainfall is heavier than on the eastern is more tropical, approximating more to that of West Africa.

WHALES IN THE ANTARCTIC

A recently issued part of Volume VI of the 'Discovery Reports' contains a paper by Dr. Stanley Kemp and Mr. A. G. Bennett upon the distribution and movements of whales off South Georgia and the South Shetlands. The figures

have been obtained from the returns, which the whaling companies have been required to render since 1922, of the positions of whales killed, and direction of movement. The whaling grounds of South Georgia are approximately 50,000 square miles, of the South Shetlands 80,000 square miles. Both Blue and Fin whales are taken in these areas: their numbers vary greatly from year to year; for one year, one species is plentiful while another is scarce, and in another, both will be plentiful. Sir Sidney Harmer relates this to some extent to the position of the ice-edge and the temperature of the water.

In South Georgia, the chief whaling ground lies to the north-east, for hydrological reasons. Two currents meet there, one from the Pacific, which is deflected by the westerly winds, and a current from the Weddell Sea, which sweeps along the south-east of the island, to join the first. At this junction, and in the lee of the island, there are great concentrations of *Euphausia superba*, the plankton drifting northwards, upon which the whales feed. Considerable differences in the areas of concentration of the whales occur from year to year. Whenever species are abundant, they move to the south-west of the island in the second half of the season. During the period under examination the areas of concentration have shifted from 40 to 50 miles to the eastward, which suggests that the whales have been scared by the whalers from their former feeding grounds. The whales are first taken off the north-west of the island, and then pass eastwards, the Fin whales in the earlier months tending to the north: at the end of the season there is often a reversal of direction, which is as yet unexplained. Though the data are insufficient, there is a strong suggestion that the intensive hunting of the last few years has brought about a large reduction in the stock of whales. In 1925–26 the total number of Fin whales taken in the South Georgia area was 5713, the most successful season. In 1930–31, the number had declined to 1416; of Blue whales, 3670 were taken in 1926–27, and 1084 in 1930–31.

In the South Shetlands, the whales concentrate at the north and south ends of Bransfield Strait, though the concentration is not so great as in South Georgia. The present evidence seems to indicate that they move first to the south-west, and then to the south-east, though the hydrography and plankton of this area is complex and not sufficiently known at present to explain their movements. If success attends a new system of marking whales introduced in 1932–33, an explanation of their distribution in these waters may be forthcoming.

EARLY USE OF MERCATOR CHARTS

Professor G. Guarnieri, of Pisa, who has written various papers on the early nautical enterprise of the Tuscans, and specially of the port of Leghorn, sends us a reprint of his latest contribution to the subject (from the *Bollettino del Consiglio . . . dell' Economia . . . di Livorno*, No. 11, 1932) in which he seeks to establish the priority of the Tuscans in the general use of Mercator charts for navigation. He says with truth that the credit for such use has been commonly assigned to the seamen of Dieppe, and to the authorities quoted by him we might add the French writer Anthiaume, who in his 'La Projection des Cartes Marines chez les Normands' ('Académie de Marine,' Paris, 1930), adopts the usual view (see p. 273). Professor Guarnieri bases his thesis on the 'Arcano del Mare' of the Englishman Robert Dudley, who spent the latter part of his life at Florence, and whom he supposes to have introduced the use of Mercator charts in that part of the world in the first decade of the seventeenth century, whereas it did not come in at Dieppe till about 1630. There is no doubt about Dudley's skill in all matters relating to the sea, and his thorough understanding of the principles of navigation, in which his early teachers must have been men like Davis and Wright. This was fully recognized in Mr. Warner's valuable introduction to

Dudley's Voyage to the West Indies, published by the Hakluyt Society in 1899 (Publications, Second Series, No. 3). But Professor Guarnieri's arguments in support of his present thesis are not altogether convincing. They appear to rest chiefly on Dudley's note to his chart of Guiana in the 'Arcano' (No. 14 of the particular charts of the American coasts). Dudley there says that his charts and instructions given to Captain Thornton for his voyage to Guiana in 1608–09 had proved of great value, particularly his warning of the existence of a dangerous bore on that coast. This warning appears on the above-mentioned chart No. 14 as finally given in the 'Arcano' in 1647, and as this is one of a series constructed on Mercator's projection, Professor Guarnieri appears to assume that his original chart was also on that projection, and that this was bound to be followed up by the general use of such charts. But the original Guiana chart, based in part on Dudley's own voyage of 1594–95, occupied a position of its own, and as it extended only to 6° N. of the Equator, its projection could show no appreciable difference whether Mercator's or not. The 'Arcano,' not printed till 1646–47, had its germ no doubt in the three MS. volumes preserved at Florence, and supposed to have been written about 1610–20, but Professor Guarnieri does not bring these into the discussion, though they might throw more light on the question. Mr. Warner quotes from the third (which, he shows, can hardly have been written before 1620) a paragraph in which the author speaks of his previous contributions to the art of navigation, adding "of these [matters], however, common sailors understand little": this hardly squares with the idea that the Tuscans were then commonly using the improved methods inculcated by him, though it may have been true a quarter of a century later when the 'Arcano' was printed.

MS. OF DA MOSTO'S VOYAGE

Professor Almagià has given in the *Rivista Geogr. Italiana*, 1932, pp. 169–176, some notes on a MS. of Da Mosto's voyage on the West African coast which has lately been sold in Italy, and which differs in a good many small particulars from the versions printed in the *Paesi Novamenti retrovati* of 1507 and in Ramusio's collection, and also from another MS. in St. Mark's library at Venice. It had formerly been owned by Prince Eugene of Savoy, and latterly by Professor F. Patetta, of Turin, but has been acquired by the Italian Minister of Education and is now also in the Marcian Library. It appears to be earlier and also more correct than the other MS., while of the printed versions that in the *Paesi* is the more correct, for that of Ramusio is disfigured by inapt alterations, perhaps due to careless copying by a scribe. Professor Almagià has made a rapid comparison of the various versions, and quotes a good many passages in which differences are found. Many consist in divergent distances and numbers, wrongly given in the previously known versions, while certain facts are put down differently. Thus the MS. now in question distinctly implies that the voyager wrote from memory, while some versions speak of notes made during the voyages. The date of sailing on the second voyage is placed in early March, as in the *Paesi*, while other versions have May. The former date does away with the inconsistency as to the date of discovery of the Cape Verde islands. In any new edition (and such is held to be very desirable), the Patetta MS. should certainly be taken as the model.

CORRESPONDENCE

THE PENEPLAINS OF EAST AFRICA

With reference to Mr. Vincent's interesting paper on "The Namuli Mountains of Portuguese East Africa," in your issue for April of this year, and to Dr. Parkinson's contribution to the discussion of it, I should like to be permitted to make a few remarks.

The three main peneplains, or erosion surfaces, that I have shown to exist in Uganda, and in part of Tanganyika, have been found by Bailey Willis to have a wide extension more or less throughout the latter territory, and it should not be impossible to correlate them with those of Portuguese East Africa of which Mr. Vincent has written. The bottom and second peneplain in that country are well displayed, to my knowledge, but I have less acquaintance with the topmost. It is possible hypothetically to equate the second and third peneplains and terrace-gravels of Uganda with the platforms of Zanzibar, but at present there is room for uncertainty in this.

I shall not attempt, in this letter, to deal with possible correlations of the Ceylon peneplains with those of Eastern Central Africa, but it may be noted that some of the field work I was able to accomplish when in Ceylon, together with some palaeontological researches on the part of Professor Morley Davies, shows that the latest of the erosion surfaces which stand above the level of the present-day valleys in that island is post-Miocene, and I hold the view that it is of no great geological antiquity. Unfortunately Professor Adams's paper on the "Geology of Ceylon" is not available here.

As to the age of the Rift-Valley faults (or of some of them at least) I have long held that those in Uganda are very old indeed, and that they were rejuvenated in late Tertiary and Quaternary times. Recent petrological researches by Dr. A. W. Groves, lately of this office, strongly support that view.

I agree with Dr. Parkinson to the extent that a factor (I would suggest a very large factor) in the formation of rift valleys was magmatic.

E. J. WAYLAND

Geological Survey Office, Entebbe, Uganda.

MEETINGS: SESSION 1932–1933

Fourteenth Evening Meeting, 29 May 1933. The President in the Chair

Elections: Ralph Morrison Cocks; Walter Frederick Dale; Philip Henry Godsell; Miss Helen May Gyles; Mrs. Leila Mary Battersby Sanderson; Albert James Walter Stead; Joseph Arthur Thornley

Paper: The South-West Libyan Desert. By Major R. A. Bagnold; read by Mr. W. B. K. Shaw

Fifteenth Evening Meeting, 12 June 1933. The President in the Chair

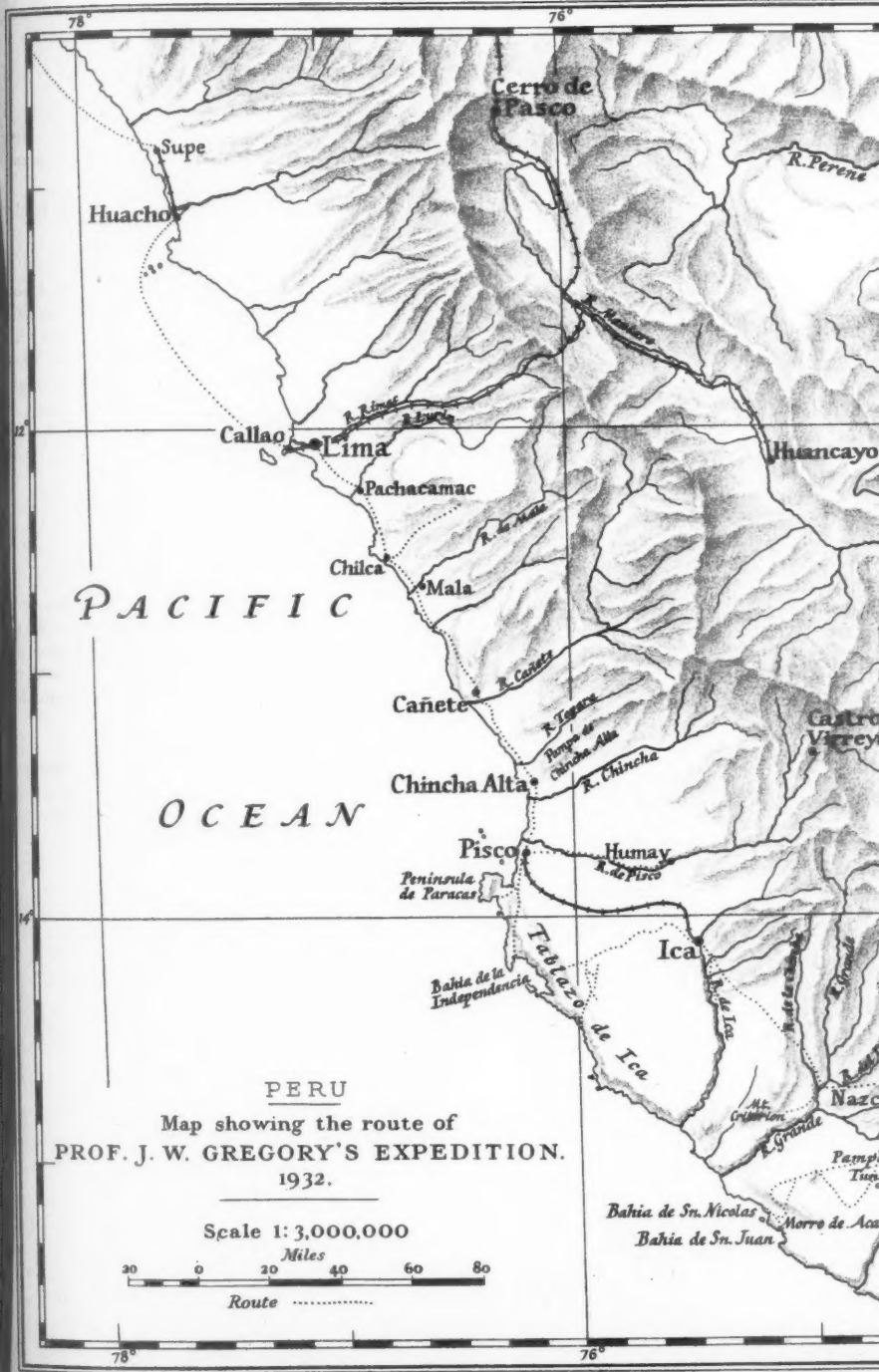
Elections: Mrs. A. T. Arnall; Miss Lucy Kezia Berry; Richard St. George Caulfield; Vernon S. Forbes; Richard Manisty Demain Grange; George Finch Hotblack; Frank Henry Kingsland, B.SC.; The Rev. Thomas Lutman; Mrs. Charlotte Leigh-Smith; Mrs. Marion Macleod; Leslie Thomas Herman Treadwell, B.A.; William Graham Anthony Watson; Miss Lilian M. C. Willoughby

Paper: The Oxford University Exploration Club's Expedition to Sarawak. By Mr. T. H. Harrisson

KHARGA OASIS: A CORRECTION

Miss E. W. Gardner writes to point out that there is a misprint in the penultimate paragraph of her contribution to "Further Remarks on the Kharga Oasis" in the June *Journal*, p. 530, line 8, where ". . . the present desert belts around the tropics of Cancer and Capricorn would have *perished*" should read ". . . would have *persisted*." We much regret that such a mistake should have escaped detection.

The interesting note in the February *Journal* (p. 186) on the "Introduction of Reindeer into Canada," over the initials H. E. M. K., was based upon a longer communication from Mr. H. E. M. Kensit of Ottawa. This should have been made clear in an introductory sentence.



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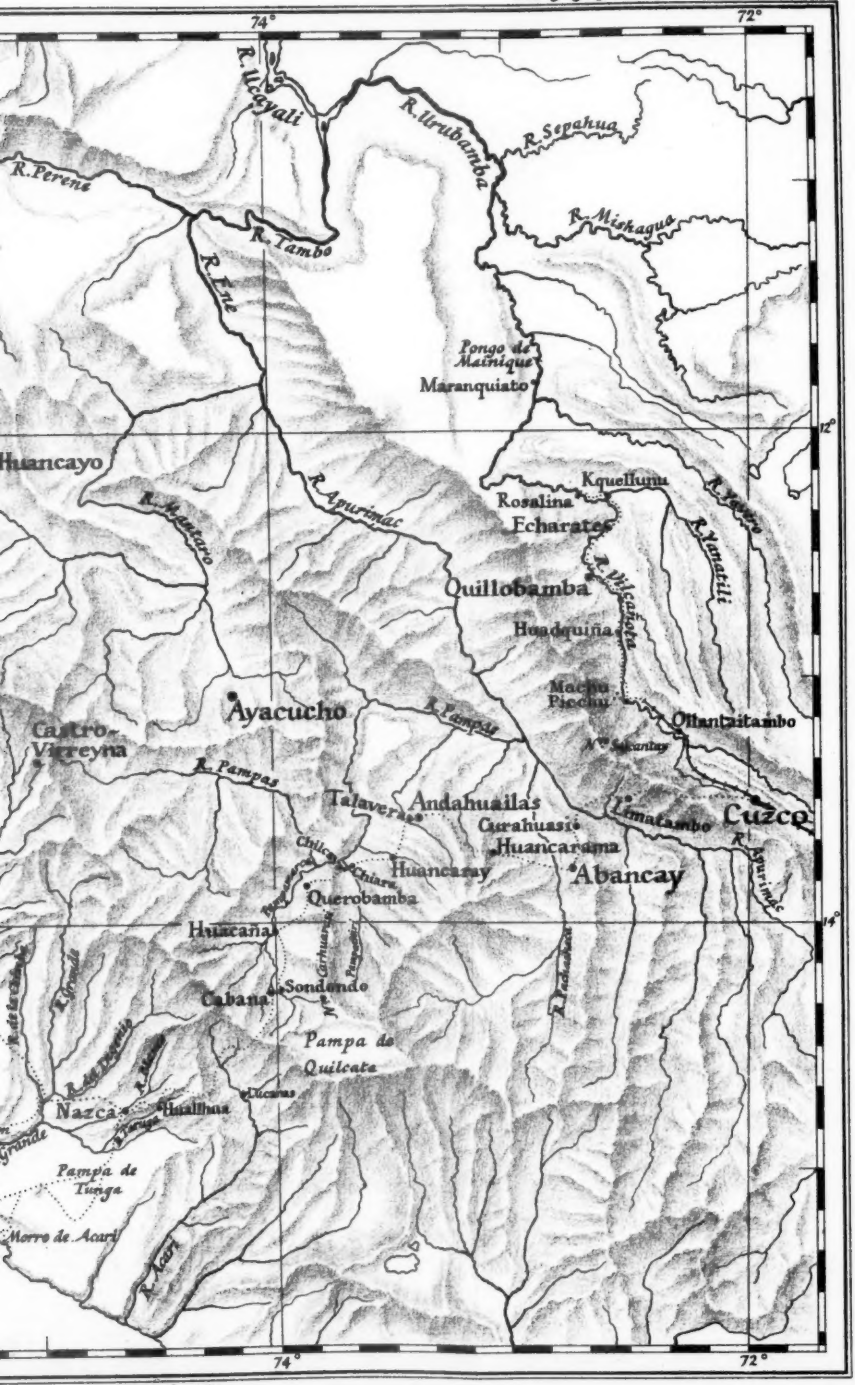

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Prof. Gregory's Expedition